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RENEWED SKILLS

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RENEWABLE ENERGY SECTOR: SOCIO-ECONOMIC DATA AND INFORMATION ON EMPLOYMENT

Introduction

Poland's energy policy objectives have been formulated in the Council of Minister's resolution of 10 November 2009 entitled "Energy Policy of Poland until 2030". With respect to renewable energy sources, the document sets out the following objectives:

- to increase the share of renewable energy sources in the final energy consumption to the minimum level of 15% by 2020, and to continue to increase this share in the subsequent years,
- to achieve, by 2020, a 10% share of biofuels in the transport fuels market and to increase the use of second-generation biofuels,
- to protect forests against overexploitation due to biomass harvesting, and to ensure sustainable use of agricultural land for the purpose of RES, including biofuels, so as to prevent competition between renewable energy production and agriculture, and to preserve biodiversity,
- to use existing state-owned water damming structures for electricity generation,
- to increase the diversification of supply sources and to create optimum conditions for the development of distributed power generation based on locally available resources.

The policy defines a catalogue of measures necessary to achieve these objectives. The measures include, inter alia, maintenance of support systems for producers of electricity from renewable energy sources e.g. by a system of certificates of origin; retaining the principle of exempting energy from renewable sources from excise tax; and direct support to constructing new RES units and power grids to which those units can be connected with the use of European funds and environmental protection funds, including those gathered in the form of the substitution fee and penalties.

The support system for producers of energy from renewable sources has aroused a large interest of domestic and international investors in this area of the energy sector. For example, in 2011 Poland was the seventh fastest-growing wind energy market in Europe.

External influences on the sector (the impact of public spending to support the sector, the impact of the Kyoto Protocol and the EU recommendations)

At the end of 1990s in the European Commission documents the term "sustainable energy policy" started to be used. This policy is intended to ensure a balance between energy security, satisfaction of social needs, service competitiveness and environmental protection.

In order to implement the common energy policy, the European Union launched a number of programmes to support the energy sector. Within the Energy Framework Programme implemented in 1998-2002, the following programmes were implemented:

- Altener programme relating to the promotion of renewable energy sources,
- Save programme relating to the reduction of CO2 emissions through the promotion of rational energy management
- Synergy programme - ensuring security of energy supplies and the implementation of the provisions of the Kyoto Protocol,
- Carnot programme - promotion of clean and efficient technologies based on solid fuels in industry,
- Sure programme – focused on measures in the nuclear energy sector,
- Stage programme - a programme of studies, analyses and forecasts relating to the energy sector.

A continuation of the Framework Programme is the programme Intelligent Energy - Europe. The final stage of the building of the Community energy market is the creation of trans-European energy networks (TENs). In 1997, the White Paper "Energy for the Future. Renewable sources of energy" was published, which contains a strategy and action plan in the field of renewable energy sources. On April 23, 2009 the DIRECTIVE 2009/28/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC. The Directive lays down a common framework for the Member States to promote the use of energy from renewable sources, and establishes mandatory national targets for the share of energy from renewable sources in gross final consumption of energy.

EU funds for supporting renewable energy sources

In addition to the legislative elements supporting the production of energy from renewable sources, as well as biofuels, an important factor encouraging investment in renewables and biofuels are EU funds (ERDF and ESF) in the financial perspective 2007-2013. The National Strategic Reference Framework provides that out of the total amount of funds for 2007-2013 (85.6 billion euro, of which 67.3 billion from the EU budget, 11.9 billion from the national public funds and about 6.4 billion of private entities' funds) about 3.1 billion euro (about 4.6% of the total EU funds) will be allocated by the EU to purposes related to the development of renewable energy sources. This will be supplemented by funds allocated to other measures (4.4 billion euro under the Rural Development Programme) which also indirectly affect the development of RES. Taking into account also public national funds (about 1.3 billion euro) and private funds (approx. 0.7 billion euro) as a contribution to the EU funds; the overall amount of about 9.5 billion euro is potentially available for use for RES development. This amount is going to stimulate the Polish economy.

A specification of possible support options for 2007-2013 from EU funds is presented in the table below.

Operational Programme Infrastructure and the Environment	Operational Programme Innovative Economy	Regional Operational Programmes (16) – examples of Voivodship (Province) level programmes	Rural Development Programme
Measure 9.1 High-efficiency energy generation; EU allocation – about 84 million euro	Measure 1.4 "Support for goal-oriented projects - Increasing the innovativeness of enterprises by using the results of R&D works carried out for their needs. EU allocation: about 331 million euro	Mazowieckie Province - Measure 4.3. Air protection, energy (not only RES) EU allocation: about 49.9 million euro	Action: Modernisation of agricultural holdings - investments related to the initiation or modernisation of production of agricultural products-food and non-food products, including products intended for energy purposes EU allocation: about 1.800 million euro
Measure 9.4 Generation of energy from renewable sources EU allocation – about 352 million euro (according to data as on March 2009, there will be 742 million PLN)	Measure 4.1 "Support for implementation of R&D works EU allocation – about 331.5 million euro	Łódzkie Province – Measure II.9 Renewable energy sources EU allocation – about 27.3 million euro	Action: Adding value to agricultural and forestry production EU allocation: about 1.100 million euro
Measure 9.5 Production of biofuels from renewable sources EU allocation – about 70.5 million euro	Measure 4.4. New investments with high innovation potential Allocation – 1.207 million euro	Zachodniopomorskie Province: Measure 4.1. Renewable energy EU allocation – about 19 million euro	Action: Basic services for rural economy and population EU allocation: about 1.5 million euro
Measure 9.6 Networks facilitating reception of energy from renewable sources EU allocation – about 47 million euro		Dolnośląskie Province: Measure 5.1 Renewable energy sources EU allocation – about 16.7 million euro	
Measure 10.3 Development of industry for RES EU allocation – about 27.4 million euro		Śląskie Province 5.3. Clean air and renewable energy sources (not only RES) EU allocation – about 44 million euro	
580.9 million EUR	**1869.5 million EUR**	**about 600 million EUR**	**4400 million EUR**

Apart from the above mentioned programmes, co-financing of projects related to renewable energy sources in the years 2007-2013 is also possible directly under the EU budget. This applies, for example, to the financing of the international programme of offshore wind power plant construction. As part of the Seventh Framework Programme (whose seven-year budget amounts to about 54 billion euro), the European Union will co-finance e.g. research and technological development related to RES. In addition, the Community "Framework Programme for Competitiveness and Innovation" (CIP) provides for a number of instruments which can also be used for the development of renewable energy sources, for instance "The Programme for Entrepreneurship and Innovation" (2.2 billion euro) and the programme “Intelligent Energy Europe" (727 million euro).

National support to RES from public funds

Substantial support for renewable energy sources comes from the National Fund for Environmental Protection and Water Management (NFEPWM). The support includes

grants, long-term low-interest loans, and support from provincial, district and local funds for environmental protection and water management. Below is a package of national solutions in the field of facilitated access to public support for RES:

National Fund for Environmental Protection and Water Management

Allocation of funds is carried out in the following fields:

- Air protection,
- Water protection and water management,
- Protection of soil,
- Nature and landscape conservation, and forestry,
- Geology and mining,
- Environmental education,
- National Environmental Monitoring
- Inter-disciplinary programmes,
- Extraordinary hazards to the environment
- Expert opinions and research work.

Voivodship Funds for Environmental Protection and Water Management

Support instruments available from Voivodship funds:

1. Loans at preferential interest rates, with the possibility of partial remission,
2. Subsidies to interest on loans,
3. Grants.

Powiat (District) Funds for Environmental Protection and Water Management

The priority axes:

1. Research and development of new technologies,
2. R&D infrastructure,
3. Capital for innovation,
4. Investments in innovative projects,
5. Diffusion of innovation,
6. Polish economy on the international market,
7. Information society – development of e-administration,
8. Information society - increasing innovativeness of the economy.

Regional Operational Programme for 2007-2013

In each region of Poland there are separate programmes for supporting investments in renewable energy sources. They apply to different types of beneficiaries, different types of investments, and cover different forms and amounts of co-funding.

The support can be sought primarily from municipal offices, powiat (district) administration offices, Voivodship (provincial) funds for environmental protection and

water management, implementing institutions for Regional Operational Programmes (entrepreneurs and public entities).

Green Technologies Centre (GTC)

GTC is a non-profit organisation's project funded by the ESF; it assumes the development of business, creation of better jobs and combating unemployment through sustainable development and utilisation of the rich natural resources of the Podlaskie province. As part of the international public-private partnership the project offers a range of free training courses, workshops and study visits to other countries, connected with environmental protection initiatives (such as sewage treatment or packaging waste processing), building and roofing works carried out in traditional ways, eco-tourism, regional products and production of biomass. The beneficiaries of the project are mainly workers and employers of SMEs which carry out such activities.

The project helped to promote the idea of a local contact-network joining both public and private entities. In areas covered by the project, awareness-building campaigns are organised and methods of improving the competitiveness of local companies are sought. Other activities include exchange of experience and working methods, and development of common products. As a result, workers and businesses can benefit from training, new education models and expert advice designed for local SMEs and associated with "green technologies" which direct or strengthen activities implemented by the participating entities. It should also be mentioned that thanks to the contact network and to the gained knowledge, GTC has become a reference centre for education and consultancy in the field of "green technology" and "green jobs" in the region. GTC also proposed the introduction of changes to the regional legislation and policies to support the development of environmentally-friendly activities.

RES support from other sources

In addition to national and EU assistance measures aimed at supporting renewable energy sources, there exist complementary measures arising from international cooperation, including among others measures such as the Norwegian Financial Mechanism and the Financial Mechanism of the European Economic Area (EEA) or funds available within the "Partnership for Renewable Energy and Energy Efficiency". Also, certain financial institutions (EBRD, the European Investment Bank and Bank Ochrony Środowiska) are interested in the financing of and capital participation in renewable energy projects.

For new Member States, Switzerland has established a new source of support. The Swiss Financial Mechanism. This support covers the following areas:

1. Security, stability and support for reforms
2. Environment and infrastructure;
3. Promotion of the private sector,

4. Human and social development.

The "Poland-Belarus-Ukraine" Programme: the aim of the Neighbourhood Programme Poland-Belarus-Ukraine INTERREG IIIA / TACIS CBC is to promote cross-border cooperation along Poland's eastern border which at the same time constitutes an external border of the European Union (EU). One of the activities under the programme is Measure 1.2: Development of common cross-border system of environmental protection.

The "Poland-Lithuania-Russian Federation" Programme: the aim of the Neighbourhood Programme Lithuania-Poland-Russian Federation (Kaliningrad) INTERREG IIIA / TACIS CBC is to promote cross-border cooperation along Poland's north-eastern border which at the same time constitutes an external border of the European Union (EU). One of the activities under the programme is Measure 1.3: Protection of the environment, increase of energy efficiency, promotion of renewable energy sources.

System of enterprises and their economic position

The energy sector is a key sector which is essential for the development of industry and national economy. In the case Poland, this sector is based primarily on coal technologies. This is due to the fact that Poland is the largest producer of coal in the European Union. However, it should be noted that the share of other energy sources in the overall "energy mix" is increasing, especially as concerns renewable energy sources.

Installed capacity of the National Power System

According to the Polish Energy Market Agency, in the end of 2012 the installed electrical power capacity was 38.292 MW. The dominant installations were thermal power plants which accounted for 32.860 MW, with particularly significant share of hard coal-fuelled power plants (20.652 MW) and brown coal-fuelled power plants (9.603 MW). For the sake of comparison, the share of installed capacity from renewable energy sources amounted to slightly more than 11% and remained at the level of 4416 MW.

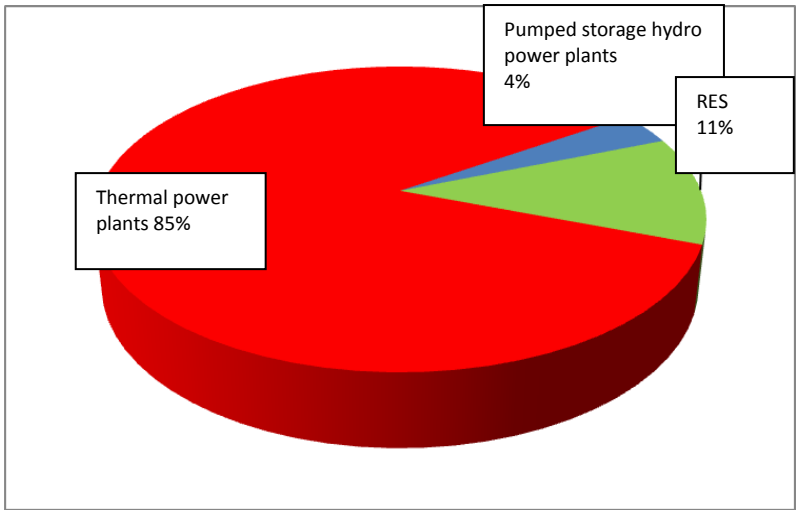

Figure 1 Shares of individual technologies in the total installed capacity in the National Power System (end of 2012)

As concerns installed RES capacity (4416 MW), the dominant sources are wind sources, hydroelectric power plants and biomass-fuelled power plants:

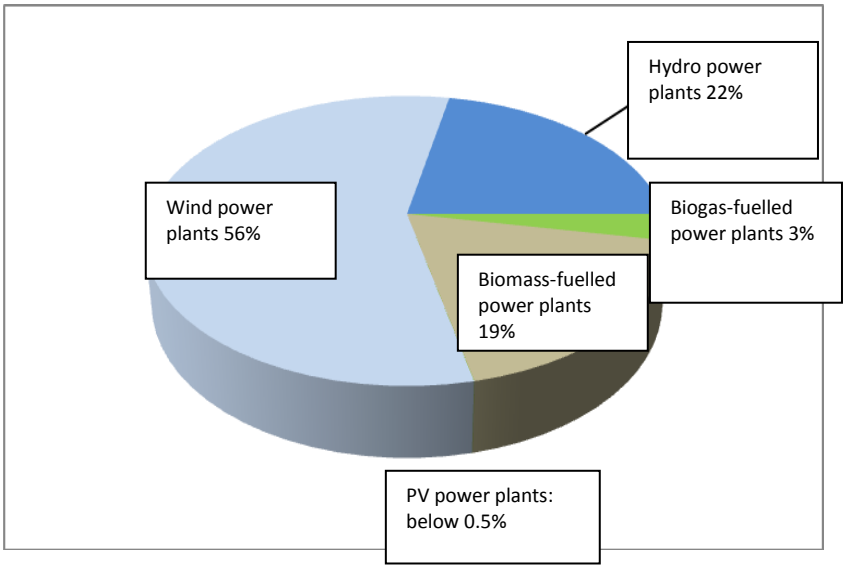

Figure 2 Shares of individual technologies in the total installed RES capacity (end of 2012)

Structure of electricity generation

Firstly, it should be noted that the structure of electricity generation over the last years has not changed significantly. Therefore, the presented structure of electricity generation refers to 2012 when the total production was 159853 GWh. This production was based mainly on two fossil fuels: hard coal and lignite. Their joint share accounted for 88% of the overall production in 2012. At the same time, in 2012 the share of lignite in the process of electricity generation increased. This was due to the dropping profitability of electricity generation based on hard coal. It should be noted that for a few years, there has been a systematic increase in electricity production from renewable energy sources.

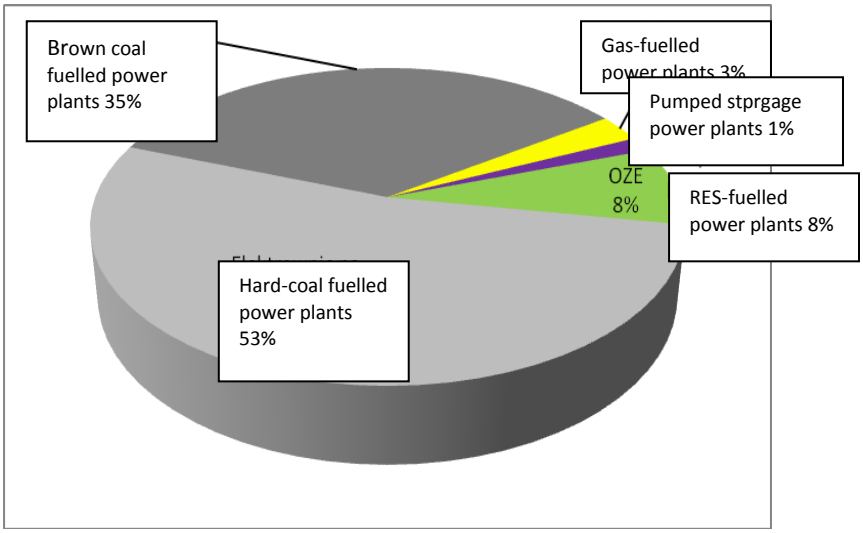

Figure 3 Structure of electricity production in 2012.

Ownership structure of the power sector

The current structure of the electrical power sector has been formed as a result of the consolidation of power companies owned by the State. The largest share in the power generation sub-sector belongs to the capital group PGE Polska Grupa Energetyczna SA. As concerns electricity sales to end users , the largest share in the market belongs to TAURON Polska Energia SA.

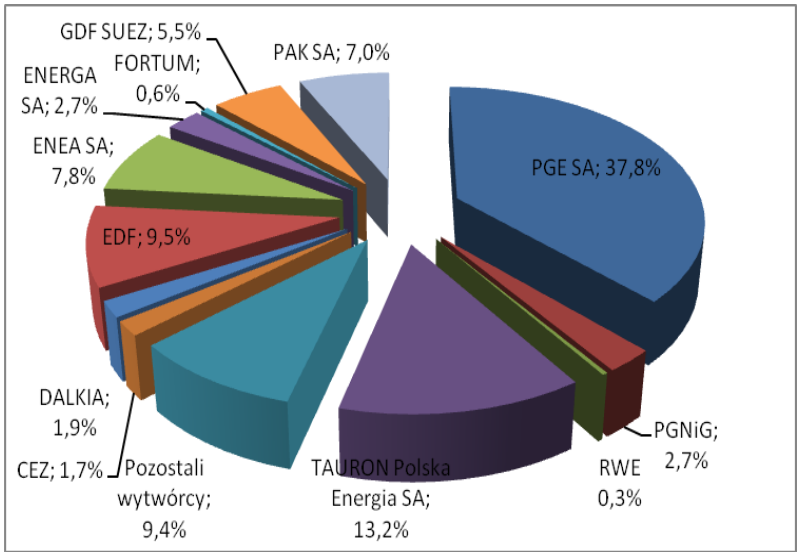

Figure 4 Shares of individual capital groups in electricity production in Poland in 2012.

Analysis of the current social situation and employment in the renewable energy sector

Jobs connected with renewable energy sources are part of the broader issue of environmental protection and promotion of sustainable development. These sectors create “green jobs” sometimes referred to as "green-collar" jobs functioning within the green economy. Currently, particularly in Poland, most of renewable energy comes from biomass. Its potential, diversity of resources and variety of processing technologies creates possibilities for the development of the labour market in this sector.

Based on the draft law on renewable energy sources (in the assessment of the effects of the regulation) estimation has been carried out of the impact of the new legal and economic solutions on the labour market. The provisions of the draft law may have a positive impact on the labour market, particularly in the sector of equipment production for the needs of RES, in the building sector connected with the construction or reconstruction of power generation units, in the banking sector providing services related to investment project financing, in the sector of services related to certification of RES installers and installation of renewable energy micro-installations, as well as in the sector of biomass production and trade for the needs of the energy sector. The table and graphs below present the possible increase in employment, resulting from investments in RES installations. The presented data take into account the increase in installed capacity, as determined in the National Action Plan (NAP).

Annual growths in employment in the field of production and use of renewable energy sources in Poland in 2012-2020:

		YEAR								
		2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Wind power	Annual employment growth	2714	3009	3009	3009	3068	3068	3068	3068	6077
	Cumulative value	2714	5723	8732	11741	14809	17877	20945	24013	30090
Biomass energy	Annual employment growth	386	297	308	274	524	557	493	837	302
	Cumulative value	386	683	991	1266	1789	2346	2839	3676	3979
Biogas energy	Annual employment growth	472	484	555	602	732	944	932	1558	1581
	Cumulative value	472	956	1510	2112	2844	3788	4720	6278	7859
Hydropower	Annual employment growth	11	11	11	11	11	11	11	11	121
	Cumulative value	11	22	33	44	55	66	77	88	209
Solar collectors	Annual employment growth	2078	1323	378	3401	4535	3590	4535	1889	3590
	Cumulative value	2078	3401	3779	7180	11714	15304	19839	21728	25318
Photovoltaics	Annual employment growth	13	325	390	390	520	520	520	585	585
	Cumulative value	13	338	728	1118	1638	2158	2678	3263	3848
Heat pumps	Annual employment growth	452	505	551	609	667	731	812	887	980
	Cumulative value	452	957	1508	2117	2784	3515	4327	5214	6194
Geothermal energy	Annual employment growth	100	120	160	280	260	320	380	40	40
	Cumulative value	100	220	380	660	920	1240	1620	1660	1700
TOTAL	Annual employment growth	**6227**	**6073**	**5361**	**8576**	**10316**	**9741**	**10751**	**8876**	**13277**
	Cumulative value	**6227**	**12300**	**17661**	**26238**	**36553**	**46294**	**57045**	**65921**	**79197**

The a/m cumulative value should be increased by the current employment which in 2010 was 28450 persons**.**

Impact of industrial development on labour market in the RES sector

In the EU, employment in the renewable energy sources sector is a result of the development of industry working for the needs of the sector. The use of renewable energy sources requires production of boilers, generators, turbines, photovoltaic cells and other devices. In Poland, a particularly high rate of growth in production and employment is seen in two sub-sectors: photovoltaics and wind power.

The previous decade was a period of rapid development of technologies of biomass co-firing with coal in thermal power plants. That development, however, did not result in any large-scale investments. In the biofuel sector, production of biodiesel from rapeseed developed. In the years 2006-2010 the renewable energy market began to change and diversify. New, promising technologies were developed and so-called independent producers of energy occurred, starting from households and ending with companies from outside the traditional energy generation.

Out of the new technologies that are already present in the market, of specific importance are thermal solar collectors, offshore wind farms and agricultural biogas plants.

Large-scale wind power plants

Polish companies have, in theory, a production potential allowing them to manufacture all components of a modern wind turbine. This conclusion can be drawn based on the fact that the wind power industry uses technologies and materials used in other branches of industry. Currently, the greatest potential in terms of the wind power industry lies in areas in which technological knowledge and production potential can be used for manufacturing power plant components. This concerns, primarily, the steel industry (towers and nacelles).

There are also attempts by western manufacturers of wind turbines to cooperate with Polish enterprises in areas which are more advanced in terms of required technologically.

The beginnings of the national wind power industry were highly promising.

- In 1980s, Państwowy Ośrodek Maszynowy - the National Centre for Machinery Production (currently named Expom) in the town of Nowe Miasto Lubawskie produced several dozen of wind turbines with capacities of 10-20 kW.
- In 1990s in Poland there was one quite large manufacturer of complete wind power plants. The company, whose origins were connected with the mining industry, was named Nowosądecka Fabryka Urządzeń Górniczych NOWOMAG SA. With its own major financial and organisational effort the company independently designed and marketed complete wind power plants with capacity of 160 kW; the plants represented state-of-the-art technology as for 1990s.
- In the niche market of smaller units with capacities from several KW to slightly over 10 kW, a company named DR Zaber tried to operate on the Polish market. The company, in cooperation with other partners, also attempted to construct a wind power plant with capacity of approximately 1 MW but the plan never got beyond the design stage.

As a result of analysing offers of suppliers of equipment and components for wind power plants, 43 companies operating in this field have been identified, out of which 28 companies provide core equipment necessary for the wind power plant technology (nearly half of them are suppliers of various types of steel structures). The other companies offer products which can be used in wind power plants but are not specifically tailored to their needs (e.g. cabling).

A wide-scope offer for the wind power industry is available from the shipbuilding and marine industry. The Gdansk shipyard is launching the production of towers for wind turbines. Components are also provided by private shipyards: Crist (THOR jack-up rig for offshore wind power plants) and ODYS (manufacturer of a prototype wave power station named Wave Star).

Small-scale wind power plants

The market of small wind power plant components (devices for individual households) has its specific features. Currently there are 124 companies operating on the market of small-scale wind power plants in Poland. These are mainly micro-and small enterprises that distribute and install autonomous domestic wind power systems (wind turbines only, or wind turbines with battery and control systems). In addition, in Poland there are also manufacturers of small wind turbines and their components (mainly towers and generators). It should be noted that companies often do not limit their activity to a single type of service (i.e. distributors and manufacturers) but also provide installation services, and their product range covers the entire renewable energy sector (mainly photovoltaic systems, solar panels and heat pumps).

Polish market of biogas and related equipment

In Poland, biogas from the agricultural sector and food waste treatment has a very small share in the overall energy balance of the country. The market is still dominated by biogas plants operating in connection with waste water treatment plants and municipal landfills. In the sector of agriculture there are currently eight biogas plants with a total installed capacity of 7.5 MWel. Among the already existing biogas plants, there are 5 installations by the company Poldanor SA (in the Kujawsko-Pomorskie and Pomorskie Voivodships), one installation built by Agrogaz in Liszkowo (Kujawsko-Pomorskie Voivodship), a biogas plant in Kalsk (Lubuskie Voivodship) and a micro biogas plant in Studzionka, operated by individual local farmers.

Poland has companies manufacturing devices that can be successfully used in biogas plants. In the country there are about 200 companies involved in the production of components for various industries. About 90 of them are manufacturers running their production activity in Poland. The others are either distributors of foreign equipment offered by the manufacturers' representatives, or installation companies.

Solar collectors

The Polish market of solar collectors is developing very dynamically. In 2009, the sales of solar collectors in Poland exceeded 144 thousand m2 which is an increase in relation to the previous (very good) year by over 11%. By the end of 2009, the overall installed area was 510 thousand m2, compared to 365 thousand m2 of the overall surface installed in 2008.

The growth of the solar energy sector in the period 2001-2009 is presented in the table below:

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2001-2009
Annual growths in the sales of solar collectors	43%	44%	61%	42%	28%	33%	41%	55%	39%	43%

The solar energy sector, as the only RES sector, is successful in exporting its products on a relatively significant scale. The Polish exports of solar collectors make up 50% of the collectors' sale in Poland, and for several years has been on the level of about 80 thousand m2. The Polish collectors are bought by Germany, Spain, Portugal, Austria, Italy, the United Kingdom, Sweden, Finland, Czech Republic, Slovakia, Hungary, Lithuania and Latvia. Three manufacturers: Sunex, Watt and Neon were winners of the "GreenEvo" competition organised by the Ministry of Environment; prizes in this competition are awarded to best green technologies exported by the country.

On the Polish solar energy market, there are about 70 companies: domestic producers of solar panels, and representations of foreign producers offering individual devices or full ready-made systems manufactured in other countries. There are about 40 quite significant players in the market."

A vast majority of the domestic manufacturers are located in the south of Poland, especially in the regions of Śląsk and Małopolska. Other regions are dominated by distributors and representative offices of foreign companies. In Poland, more than 170 types of solar collectors are produced, and nearly the same number is offered by foreign companies' distributors.

The first Polish collectors were developed, and their manufacturing companies were established, in 1990s. The pioneer in the field of solar technology was a company named **Aparel** (later acquired by the Polish company ERGOM operating in the electrotechnology industry). In 1993 Aparel began producing absorbers for solar collectors for companies from Germany and Austria, and in the mid-nineties, apart from the absorbers, it started producing flat-plate liquid collectors. In the same period, the **HEWALEX** company started its manufacturing activity. At present, the company offers several types of flat-plate solar

collectors and vacuum collectors. The company **SUNEX** of Racibórz offers the widest range of solar collectors (over 120 types), and specialises in producing OEM collectors; a major part of its production is exported.

Polish companies also invest in new production plants. Examples of such investments include those made by the companies **ENSOL** and **WATT** from Chorzów; the latter has built a factory with an area of 25 thousand m2 in Katowice Special Economic Zone, using the funding obtained under the Operational Programme Innovative Economy - Measure 4.4 "New investments with high innovation potential". Manufacturers of solar collectors in Poland are mainly small and medium-sized enterprises. They include some companies that produce 10 to 50 thousand m2 of solar collectors per year (six companies represent 60% share in the market).

PV

Poland's participation in the global and European market of photovoltaic systems is negligible. At the end of 2009, the total installed capacity in this sector in Poland was only about 1 MW. All the specialist equipment i.e. photovoltaic systems was imported from abroad. So far, photovoltaics plays no role in the national electricity balance and even plays no role in the production of green electricity.

In Poland, there is some potential for manufacturing electronic components connected with PV systems (controllers, inverters and meters) as well as manufacturing of batteries. Examples include: Electronic Components Plant "TWERD" which produces inverters, the Jabil company and a manufacturer of batteries - Wamtechnik.

Geothermal energy

The sector of geothermal energy-related equipment production in Poland is usually associated with geothermal heat pumps which are used both in the so-called. deep geothermal energy systems (heating systems) as well as shallow geothermal energy systems (heating and cooling systems for households). However, the more active markets are the shallow (low-temperature) geothermal energy market and the market of geothermal heat pumps. These markets develop in connection with the needs of the housing sector (mainly individual owners of single-family houses), and the market of heat pumps for the service sector, offices and industry which is not based only on the use of renewable energy resources.

Most companies which offer heat pumps in Poland are international companies operating in the heating sector, such as De Dietrich Technika Grzewcza Sp. z o o, Buderus, Danfoss Sp z o o, Glen Dimplex Polska, Junkers, Robert Bosch Sp. z o.o., Stiebel Eltron-Polska Sp. z o.o., VAILLANT Sp. z o.o., VIESSMANN Sp. z o.o. A much smaller group are Polish companies dealing with the production of heat pumps (these include: Hibernatus - one of the oldest companies on the Polish market, VATRA, Solis, Nateo and Ekontech). Furthermore, an important role in the market is played by foreign-origin companies that specialise in the heat pumps only, such as Ochsner, Nibe, Hydrotech – a representative of Alpha-Innotec, and Sun-Energy – a representative of IVT.

At present, the dominant market in which the products are sold is the domestic market. Small quantities of the products are exported, mainly to countries in Central and Eastern Europe. The exports constitute approximately 3% of the total annual sales. It should be

noted, however, that the figure will grow rapidly over the next years due to the rapid increase in the use of heat pumps in the Central and Eastern European countries.

Small-scale hydroelectric power plants

The demand for equipment for hydroelectric power plants in the Polish market is very small. Therefore, there are very few companies in Poland which specialise in the production of equipment connected with this type of power plants. Consequently, investors often use services of companies which specialise in producing equipment for other sectors of the economy, particularly for thermal energy plants and for water management systems.

In hydroelectric power plants the specific devices that are present in all installations are first of all different types of water turbines. Due to the hydrological and topographical conditions in Poland, the vast majority are turbines designed for low head power plants (less than 5m water column) and ultra- low head power plants (less than 3 m of water column). Therefore, manufacturers' efforts are focused on the design and manufacture technologies for turbines of this type.

Industries for RES

A preliminary review has been carried out of such industries as defence, shipbuilding and electrical engineering industry, which are looking for alternative production profiles (such as the first two of those mentioned), or want to expand the existing product range by new devices in the field of "green technologies". But there are many other branches of industry which seem promising for the renewable energy sector: aircraft industry, automotive industry and electrical engineering. At this stage it is difficult to map them from the point of view of renewable energy sources. There is no statistical data related to RES on those industries. Yet, it should be assumed that in the renewable energy sector, to an extent much greater than in other sectors, the launching of equipment production for the sector's needs takes the form of establishing new companies, even "start up" companies. In general, however, the main option selected by entrepreneurs is the extension of the existing operations in other sectors and industries by the manufacturing of equipment for such renewable energy sources which are the closest to the company's core operations in terms of technology and market.

SOCIAL SITUATION AND EMPLOYMENT IN THE RENEWABLE ENERGY SECTOR

The sector's employees: social and institutional profile

The European Union's concern with the climate change as well as the search for green, reliable energy sources is increasingly impacting the educational offer of universities and training companies. It is not surprising, therefore, that the rapid expansion of the renewable energy industry exerts pressure for the constant occurrence of new skilled engineers and technicians. Across Europe, the shift towards low-carbon economy and the growing importance of knowledge-based economy, in particular the diffusion of information and communication technologies and nanotechnologies, offer a great potential for job creation. In the tertiary sector there is a uniform trend towards broadening the range of skills required at all levels of professional work connected with "non-routine" tasks. The renewable energy industry, as many other sectors based on specialist knowledge of employees, is going to increasingly require its employees to have managerial skills as well as scientific and technical knowledge.

However, in order to avoid a shortage of human resources, which could jeopardize the prospect of development of renewable energy technologies and the related services sector, it is important to make potential employees, in particular the younger generation, aware of the opportunities connected with the sector. Information on the careers available within the sector is now available at high schools, at the stage when students select their preferred courses. The information is also available from employment offices and training centres. This is a key step towards revision of the profiles jobs such as a plumber or electrician, which play an important role in the development of renewable energy technologies. It is also important that companies' demand for specialised training and skills finds an appropriate response by training centres, universities and laboratories.

An important point of reference in the context of the labour market in Poland is the "Human Capital Operational Programme" (HC OP) for 2007-2013, co-financed by the European Social Fund. The objectives of the programme were, however, determined in 2006 and do not contain any clear references to the "green economy" strategy. Before the review of the Human Capital Operational Programme, which took place in 2011, inter alia in relation to the "Europe 2020" strategy's objectives relating to the "green economy", there was a substantial gap between the training programmes offered by both private and public institutions, and the market demand, particularly in relation to the needs of the "green economy".

Most training institutions have no knowledge about the "green economy" and about qualification gaps which need to be filled in this area. On the other hand, certain cases of ineffective implementation and management of ESF funds might have done more harm than good as regards the development of the market of high-quality training in the fields of vocational skills and lifelong learning. In particular, there has been a dynamic yet

chaotic growth in the number of training institutions and offered courses which were not always adjusted to the real needs of employees. Such a situation may have been a result of access to substantial funds available within a relatively short period of time, without appropriate monitoring and evaluation. There are also great difficulties in identifying and forecasting future jobs and requirements relating to the skills required to perform them. Although Polish companies know best what kinds of competences they need at present, they are not able to predict the competences which will be required in the near future, in particular in view of rapidly changing circumstances and technologies - including technologies related to the "green economy". In this situation of uncertainty, the principle applied in relation to training courses offered in Poland is to react to the current demand: if there is no need for training in the field of implementing "green solutions", the organisers do not provide such training until the demand for it occurs on the side of private companies or public administration. However, this approach does not work in the case of the need for more long-term, expensive or specialised training. This is rather a domain of educational institutions such as universities and technical universities which in Poland maintain a high level of education despite the lack of the ability to forecast future changes or demand for competences companies will seek as a result of these changes. In this case, the establishment of partnerships between universities and business representatives seems to be the key to understanding and predicting the necessary competences. At the same time, technical universities and other universities involved in the field of innovation should receive adequate funding in order to create reliable mechanisms of cooperation with national and international companies representing high-tech industry.

Companies are rarely involved in the development of curricula and are not interested in sharing their knowledge with students, especially in the case of technical skills in the field of "green economy", because they do not see this as a direct benefit for themselves. According to the opinions of employers and to the findings of other surveys, appropriate knowledge and competences related to the "green economy" are in many cases relatively easy to acquire through the fastest (and currently most convenient for employers) method of on-the-job training.

In many cases, there is also a demand for highly qualified staff such as, for example, engineers able to apply their knowledge in the building of new models and systems. Their skills will also be useful in other, more complex areas such as heat recovery and wastewater treatment. These highly specialised skills are not easy to acquire at Polish universities which are too heavily focused on theoretical knowledge. In addition, training for highly qualified technical engineers are more expensive, and funds allocated to such training are allocated depending on the number of people to attend the training, and not based on the training’s cost. Finally, there is the question of certain technologies associated with the transition to a more "green economy". Those technologies develop in a very dynamic way and get outdated very quickly (e.g. energy efficient products, solar

panels, batteries, insulation materials, etc.). This requires companies to be very flexible and ready to use every opportunity to apply new technologies, processes and methods at a very fast pace. Therefore, companies need to adapt the skills of their employees to the requirements of the new products, processes, services and methods, which is not always easy to achieve. Therefore, large companies usually organise internal training for their employees, very often in cooperation with external contractors carrying out such training. A good practice is internships for students within the companies. This type of subsidised internships is perceived as an appropriate way of bridging the gap between representatives of business and science.

Employees: newly emerging professions

Technical progress resulting from the development of human civilisation contributes to the occurrence of many new professions and specialisations. The largest growth in the development of new technologies took place in the twentieth century. However, in our times, new jobs occur not over centuries, but over years or even months.

Within the next 10-15 years it is expected to experience a sudden increase in the renewable energy sources' significance for the economy. Electricity generation capacities based on renewable energy sources will increase, in most cases, even several dozen times. Particularly high increases are expected in the fields of wind power, biomass and biogas.

Taking into account the above considerations and significant shortages of qualified staff in these fields, it is necessary to take steps to fill the competence gap in the renewable energy sector. The building and operation of wind farms and biogas plants is going to generate demand for specialists in the field of renewable energy sources.

In view of the open labour market across the European Union, and the calculations by the European Commission, according to which at present there are about 550 thousand people working for the renewable energy sector within the EU, and in 2020 the number is expected to reach more than 1.5 million, it should be noted that the key issue seems to be the development of training courses related to renewable energy sources. The demand for professionals in this field will occur not only on the Polish labour market, but also the labour markets of other Member States of the Community. Bearing in mind that at present the Polish labour market has very few specialists in the field of renewable energy sources, it is of key importance to develop training programmes and educational institutions which will ensure the occurrence of specialists in this field on the labour market.

Professions:

RES equipment installer is one of the jobs for the future as the sector of renewable energy sources (RES) is one of the most dynamically developing sectors of the Polish economy. The area is very wide-scope so such specialists may seek employment in the

industry in general and in narrow fields of specialisation connected with hydro power, wind, geothermal, solar and hydrogen energy. The main tasks for this job are to organise, install, maintain and repair RES equipment and systems. The objective of work of the renewable energy equipment installer is to assemble and disassemble solar collectors, heat pumps, photovoltaic systems and other renewable energy devices associated with the implementation of various construction projects that use solar, hydro, wind, geothermal and hydrogen energy.

The installation process is dependent on equipment to be installed, which is associated with the following professional tasks:

- Selection of tools, materials and equipment for the installation of biomass boilers, heat pumps, solar panels and PV cells,
- Installation of a/m systems,
- Current monitoring of their operation,
- Preparing the equipment for technical acceptance,
- Provide information to users on how to properly use the installed equipment.

The maintenance and repair of RES systems requires skills connected with ensuring their undisturbed work, their cleaning and maintenance, identification of defects, replacement of worn parts, their repair and disassembly. Additional duties may include preparation of cost estimates, contracts or offers related to the assembly and monitoring of those devices. The installation is performed on the basis of drawings and designs, and therefore an important task of RES equipment installers is the ability to correctly read the drawings and plans and to perform all works in accordance with them and using the specific technology in question. RES equipment installers are also required to be able to use tools for measuring electrical energy parameters and tools and equipment for soldering, threading and welding.

The role of RES installers is increasing along with the increase of the share of small-scale RES household installations and installations used by farmers and small businesses. This is related to:

- poor preparation of small investors to implement RES investments (non-company investors, particularly from outside the energy sector),
- installers' role as advisors/ designers
- limited possibilities (mainly due to high costs) to install comprehensive metering and monitoring systems to ensure professional monitoring of their work and actual efficiency.

Directive 2009/28/EC draws attention to the specificity of the development of micro-sources, and requires that by 31 December 2012, in all Member States (Article 14), installers of small boilers fuelled with biomass, of photovoltaic systems. solar thermal systems, shallow geothermal systems and heat pumps should have access to certification systems or equivalent qualification schemes. This, in turn, requires the

establishment of accredited units and training programmes (Annex IV to the Directive). Poland's National Action Plan also takes into account other small-scale RES technologies such as small wind turbines and micro biogas plants ("container type") whose work and efficiency depends mainly on the quality of work of the installer. With the diversification of renewable energy sources the list of micro-sources used in Poland in practice is very long. Moreover, in the installers' training for the purpose of their certification and professional qualification it should be taken into account that it is going to be more and more common to install and use renewable energy sources at the same time (hybrid systems). This entails the need to integrate the sources with power consumption and distribution management systems such as Han, NOP, etc.

Qualifications to be completed:

- Technician's diploma,
- Knowledge about heat pumps and their installation,
- Training, technologies, systems,
- Knowledge of solar (photovoltaic) installations and solar collectors,
- Knowledge about biomass,
- Installation and operation of RES,
- Central heating systems' organisation
- Energy certificates E and D,
- RES Certificate
- Installation of biogas plants.

RES equipment and systems technician. Graduates of schools which provide courses in the profession "RES equipment and systems technician" should be prepared to organise and perform works associated with installing renewable energy systems, installing and disassembling equipment which enables the use of renewable energy sources, monitoring the work of RES equipment and systems, and maintaining and repairing RES equipment and installations. People familiar with the latest developments in renewable energy sources and with relevant legislation in this field will be prepared to perform tasks related to the commissioning of renewable energy sources with the support of legislation applicable to the area of: building, energy, environmental protection, water and wastewater management.

Qualifications to be completed:

- Technician's diploma,
- RES technologies, equipment and materials,
- Solar collectors,
- Heat pumps
- Electrical license.

RES equipment maintenance employee

Qualifications to be completed:

- Technician's diploma,
- Training, systems and technical knowledge,

- Knowledge about solar (photovoltaic) installations
- Knowledge about biomass systems,
- Knowledge about heat pumps,
- Licence to work at height,
- Energy certificates E and D,
- Maintenance qualifications.

RES installation designer

Qualifications to be completed:

- Diploma in engineering,
- Knowledge about solar (photovoltaic) installations
- Knowledge about heat pumps,
- New RES technologies,
- Software for designers,
- Energy certificates E and D,
- Knowledge about biomass systems.

RES equipment sales representative

Environmental educator - teacher at schools with different levels and profiles, carrying out and coordinating education and attitudes n the field of environmental protection and sustainable development.

The tasks of environmental educator include:

- Teaching the subject of "environmental protection" and related subjects
- Introduction of environment-related teaching content to schools and other educational entities,
- Education on the regional level
- Organising and conducting education outside schools (the so-called “green school” courses)
- Education during various actions and events, in cooperation with pro-environmental organisations,
- Tailor-made environmental education programmes (for interested entities).

Environmental educator should have a university degree in the field of environmental protection, and should have certified teaching skills.

Environmental Inspector – works for the State Inspectorate for Environmental Protection and is responsible for monitoring the compliance with applicable laws and regulations relating to environmental protection within a specific area. Currently, the regulations include both domestic law and EU directives in this field.

The tasks of environmental inspector include:

- Business entities’ monitoring with respect to environmental protection,
- Monitoring the procedures in the field of environmental protection and spatial development,
- Implementation of new legal regulations into the activities of local governments and other public administration entities,
- Cooperation with law enforcement authorities, public administration bodies, local governments, etc..,

- Environmental certification,
- Performing tasks assigned by top-level environmental protection entities in the country,
- Monitoring the work of equipment used for the purpose of environmental protection,
- Determination and assessment of the state of the environment and the changes taking place in it,
- Identification and prevention or reduction of negative impacts on the environment from technical installations and equipment,
- Verification of the compliance of newly commissioned buildings and technical devices with relevant design documentation and environmental protection requirements,
- Conducting observation activities and assessment of compliance with emission standards and the quality of the environment in connection with the operation of technical installations and devices,
- Development of installation and operating manuals for equipment used for the purpose of environmental protection,
- Activities connected with applications for environmental permits and approvals regulating the use of the environment,
- Development of audit documentation and follow-up documentation,
- Monitoring the compliance with environmental quality standards,
- Gathering the results of measurements and studies related to the state of the environment; data analysis and drafting of periodic reports and assessments relating to the state of the environment,
- Planning and organising own work and work of own organisational unit,
- Collecting and updating relevant legislative acts, and informing employees about recent changes in the legislation,
- Organisational activities aimed at protecting human life and health and the environment in the case of major accidents,
- Cooperation in the development of companies' modernisation and development plans in order to ensure that their impact on the environment is minimised,
- Cooperation with other organisational units in the development of reports and the processing of data and information necessary for imposing environmental fees and penalties,
- Cooperation in actions combating environmental hazards and in the removal of effects of major industrial accidents,
- Implementation of high-quality management systems.

Environmental inspector is required to hold a university degree obtained at a university department which provides education in natural science, e.g. in environmental protection or similar subject.

Countryside ranger – a field employee who supports administration entities and other entities in enforcing standards, regulations and good practices in the field of environmental protection and sustainable development.

The duties of countryside ranger include:

- Taking samples, conducting the necessary tests and performing any other checks to determine the state of the environment within the inspected property, building or part thereof, and to assess this state in the light of applicable environmental regulations,
- Evaluation of methods of using machinery and technical equipment, including means of transport,
- Evaluation of the effectiveness of environmental protection equipment and technologies used
- Participation (within the assigned task area) in the system of environmental parameters measurements, assessments and forecasts, adopted by public administration bodies, municipal authorities, universities and businesses (the national environmental monitoring system).

RECOGNITION OF QUALIFICATIONS: EXPERIENCE IN THE SECTOR

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

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

Professional electrician licenses

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

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

The associations which carry out relevant courses and qualifying examinations include:

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

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

- Networks, devices and installations which generate, transmit or consume electricity:
    1. Generator units connected to the power national grid, regardless of their nominal voltage
    2. Networks, devices and installations with voltage up to 1 kV,
    3. Networks, devices and installations with nominal voltage over 1 kV,
    4. generating units with power over 50kW,
    5. electrothermal devices,
    6. electrolysis units,

7. street lighting systems,
8. overhead power lines for means of transport,
9. explosion-proof electrical equipment,
10. control and measurement devices, and automatic control and protection devices for equipment and systems indicated in points 1 through 9.

- Devices which generate, process, transmit and consume heat, and other energy-related devices:
  1. Steam and water boilers using solid, liquid and gas fuels, with power over 50 kW, together with auxiliary equipment,
  2. Heat networks and systems together with auxiliary equipment, with heat transmission over 50 kW,
  3. Water and steam turbines with power over 50 kW, together with auxiliary equipment,
  4. Industrial devices receiving steam and hot water, with power over 50 kW,
  5. ventilation, air-conditioning and refrigeration devices with power over 50 kW
  6. pumps, exhaust fans, ventilators and fans with power over 50 kW,
  7. compressors with power over 20 kW and compressed air systems and industrial gas systems,
  8. fuel loading, storage and unloading devices, with a storage capacity corresponding to mass over 100 Mg,
  9. industrial furnaces with power over 50 kW,
  10. control and measurement devices, and automatic control devices for equipment and systems indicated in points 1 through 9
- Devices, systems and networks which generate, process, transmit, store and consume gaseous fuels:
  1. devices for gaseous fuel production; gas generators,
  2. devices for processing and treatment of gaseous fuels; fanning systems for gaseous fuels, natural gas processing equipment, gas purification devices, liquid gas decompression and bottling devices, nitrogen removal plants, mixing devices
  3. equipment for gaseous fuel storage,
  4. gas transmission networks with pressure over 0.5 MPa (gas pipelines, gas stations, gas compressor stations),
  5. gas distribution networks with pressure over 0.5 MPa (gas pipelines, gas stations, gas compressor stations),
  6. gas devices, systems and appliances with pressure not exceeding 5 kPa
  7. gas devices, systems and appliances with pressure over 5 kPa
  8. industrial-scale gaseous fuel receiving units with power 50 kW,
  9. gas turbines,

10. control and measurement devices, and automatic control devices for networks, devices and systems indicated in points 1 through 9.

Specific ranges and types of devices in the above-mentioned groups are determined in the Regulation of the Minister of Economy, Labour and Social Policy of 28 April 2003 laying down detailed rules of certifying qualifications of persons involved in the operation of devices, systems and networks (Journal of Laws of 21 May 2003).

All persons engaged in the operation of devices from each of the above-mentioned groups has to have a qualification certificate corresponding to the type of equipment operated and the type of work done. Work with the individual types of devices is described as work in the field of the devices' operation, maintenance, repair, control, measurement and assembly. Depending on whether a specific person directly performs the above-mentioned works, or manages the performance of those works by other persons, he/she a relevant license for their performance or supervision.

There are the following groups of positions:

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

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

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

- mid-level managers – persons who manage project teams or are going to be responsible for the implementation of investment projects in the future,
- representatives of development companies from the sector of renewable energy sources,
- representatives of the conventional energy sector,
- representatives of financial institutions participating in investment projects in the renewable energy sector,

- representatives of small and medium-sized enterprises involved in energy-related investment projects,
- representatives of local government units responsible for energy strategy development and implementation.

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

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

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