

# RENEWABLE ENERGY – A NEW DIRECTION IN THE EUROPEAN ENERGY MARKET EVOLUTION

Delia Vasilica Rotaru\*

**Abstract:** Nowadays, renewable energy represents one of the most debated subjects on the global energy market. The global warming and the constraints of the traditional energy resources led to the reorientation of countries in exploiting alternative resources. This paper offers a presentation of the main sources of renewable energy present worldwide and the way these can be exploited. Also, the paper analyses the main policies and taxes put in practice by the EU members to support the development of renewable sector, given the 2012/27/EU Directive that establishes several targets that need to be achieved on the market by 2020. Finally, the evolution of the main renewable energy market indicators is being reviewed, showing that considerable progress has been made in the last few years.

**Keywords:** Renewable energy; energy efficiency; CO2 emissions.

**JEL Classification:** Q01; Q42; Q54.

## INTRODUCTION

The renewable energy sector has become of more and more interest worldwide especially as the promotion of energy efficiency is one of the main objectives for the electricity industry at a global level. Along with the industrial revolution, the use of conventional resources, such as coal, oil, natural gas, has been increasing year by year. As the nations evolved and the number of inhabitants with access to energy sources has grown, meeting the worldwide consumption needs became a real challenge taking into consideration that the conventional resources are limited. In order to sustain the development of an energy efficient environment, the European Union has given numerous directives in this area, the last one being published in March 2011 and approved in 2012, the 2012/27/EU Directive, which establishes several objectives for the member states in order to achieve the Europe 2020 targets.

The member states have to establish a national action plan to ensure that a percentage of the energy supplied to the customers comes from renewable resources. In order to achieve this, the members of the EU started to introduce different taxes on the invoices to support the renewable energy industry such as: climate change levy, feed in tariff, renewable obligation, green certificates, etc. Another objective of these plans is to put in place ways of reforming the access to the electricity networks in order to favor the use of renewable energy.

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\*Delia Vasilica Rotaru is a PhD Student in Economics at the Faculty of Economics and Business Administration within Alexandru Ioan Cuza University of Iasi, Romania; e-mail:rotaru.delia@yahoo.com

## 1.RENEWABLE ENERGY SOURCES

The traditional energy sources such as oil, gas, electricity, have a fluctuating trend in the international markets. Given their strategic importance for a nation's wellbeing and economic development, energy resources have always been a subject of interest worldwide. Some nations have far more resources than others and have taken advantage of this situation in order to influence the international relationships, making the energy resources a good that is particularly sensitive to any diplomatic tension. Also, other significant aspects in the energy equation are the nature of increasingly limited oil and gas resources and the sustainable development issue. All these factors have increased the interest in the exploration of new energy sources and brought the renewable resources into the center of attention.

Renewable energy is considered to be any resource that can be transformed into energy and that has the potential to regenerate itself in a short period of time or that is inexhaustible. These resources are turned into energy, most often electricity, using the latest technology in this area (Department of energy, 2001). The most common renewable energy sources are: solar energy, biomass energy, wind energy, water energy, and geothermal energy.

### 1.1.Solar energy

The solar energy concept refers to energy that is directly caused by the transfer of the light radiated by the sun. Solar energy is considered renewable energy and underlies most forms of energy on Earth. This can be used to generate electricity or to heat the air inside of buildings. Although solar energy is renewable and easy to produce, the main problem is that the sun does not provide constant energy in any place on Earth. In addition, due to Earth's rotation on its axis, and thus the alternation of day and night, sunlight can be used to generate electricity only for a limited time each day. Another limitation of this type of energy use is the existence of cloudy days when solar energy capture potential decreases due to shielding sun sensitive, limiting the application of this form of renewable energy technologies.

Electricity is produced using solar energy through the use of **photovoltaic system** technologies. The photovoltaic panels capture the light coming from the sun and absorb it into its semiconductor material where is further converted into electricity (Goffman, E., 2008). The use of solar energy leads to significant savings on the electricity bills and reduction of air pollution.

Moreover, the solar panels installations last for more than 30 years. In the European Union, the photovoltaic systems industry is continuously developing, as more and more countries are investing in solar energy projects. In 2008, the energy produced through the photovoltaic systems has reached 9500 MW (European Communities, 2009).

### **1.2. Biomass energy**

The biomass is the biodegradable fraction of products, waste and residues from agriculture, including vegetable and animal substances, forestry and related industries, as well as the biodegradable fraction of industrial and urban waste (e.g. wood, straw, leaves, corn and agricultural residues). Biomass is the most abundant renewable resource on the planet. This includes absolutely all organic matter produced by metabolic processes of living organisms.

The biomass energy is the energy obtained by direct combustion, obtaining electrical or heat energy. Also, by applying a various number of technologies it is possible to obtain liquid fuel suitable for the ignition of different gas engines. The main advantages of the biomass energy are the price, abundance, recycling potential, less harmful to environment (McKendry, P., 2001).

### **1.3. Wind energy**

By exploiting the power of the wind we can obtain electricity using wind turbines systems. These transform the kinetic energy of wind into electricity directly, by turning a generator. This type of energy was first used in the '70, mostly in Europe. The price of the wind energy is continuously decreasing. Nowadays, the wind energy enjoys competitive prices compared with other energy sources, making this sector to grow fast.

The global installations that produce energy using wind power have reached the total production capacity of 282 482 MW in 2012, being one of the most important sources of electricity coming from renewable resources. 22 countries have over 1000 MW installed turbine capacity, Romania being among them. In Europe, Germany and UK are leading the wind energy market. Romania, Italy, Poland and Sweden are emerging markets that had a surprising contribution in 2011 (TPA Horwath, Schonherr, 2013). The advantages of wind power technologies are numerous as these create electricity at lower prices, are environmental friendly and have predictable production costs. The disadvantages are given mainly by the intermittency of the supply.

#### **1.4. Water energy**

The hydroelectric power is also used to produce mechanic energy that is converted further into electricity. The energy of flowing water has been used since ancient times. Hydropower exploitation potential depends on the drop and the flow of water available. If the fall and flow available are larger, the electricity production capacity is higher. Hydropower represents one of the most popular renewable resources used for electricity generation.

At the global level, the energy produced exploiting hydropower has reached the total amount of more than 3288TWh in 2008 and is expected to grow to 6000TWh in 2050 (International Energy Agency, 2010).

#### **1.5. Geothermal energy**

Geothermal energy represents a very powerful and effective way to extract renewable energy from the earth through natural processes and can be used to power a home or larger settlements. This is obtained by capturing hot water and steam from the volcanic activity and tectonic areas or of underground heat.

One of the world's largest producers of geothermal energy is United States. Iceland has also a lot of resources, with more than 25 active volcanoes. The advantages of geothermal energy are represented by their low cost, efficiency, and the fact that it is environmentally friendly and the main disadvantage is the relatively small area where it can be obtained, i.e. near tectonic joints. At the worldwide level, the use of geothermal resources generated a total of 38TWh electricity in 2005 (Herzog, A., et all, 2001).

## **2. SUPPORTING ELECTRICITY PRODUCTION FROM RENEWABLE SOURCES**

Realizing the strategic importance of the energy industry, the European Union has adopted a plan in order to promote energy efficiency and security by supporting the use of renewable resources in generating electricity. The opportunities for economic growth through innovation and a sustainable competitive political energy have been recognized. Energy production from renewable sources often depends on small and medium enterprises (SMEs), local and regional. The opportunities for growth and jobs created in the Member States by the investments in renewable energy production at local and regional level are considerable. Therefore, the Commission and

Member States started to support national and regional development measures in these areas, to encourage the exchange of best practices in the production of energy from renewable sources between local and regional development initiatives and promote the use of structural funds in this area.

The Europe 2020 energy strategy adopted in 2012 promotes the efficient use of energy, the reduction of emissions, improvement of competitiveness and reduction of energy prices. The efficiency is to be achieved by investing in modernizing the existing infrastructure, as well as promoting the use of renewable resources and creating an integrated energy market (European Commission, 2011).

In order to sustain the use of renewable resources, the European countries have adopted different legislation and taxes, translated into a national action plan on renewable energy. The most common taxes that support renewable energy and energy efficiency are climate change levy, feed in tariff, renewable obligation, green certificates, etc.

a) Climate change levy tax

The climate change levy tax was introduced in United Kingdom in 2001 in order to support energy efficiency and reduce carbon emissions. The tax is applied for the industrial consumers for both power and gas at different rates that have been increased each year in April. Energy that comes from renewable resources is automatically exempted from climate change levy tax. By applying this tax, the government managed to raise awareness on the source of the energy used and reduce emissions (National Audit Office, 2007). The climate change levy tax had its benefits as the government tried to encourage the use of renewable resources by putting in place the climate change agreements offering discounts for the consumers of green energy. The maximum discount for the electricity consumption is of 90% and of 65% for gas.

b) Feed in tariff tax

The feed in tariff charge is present in different countries, supporting the use of renewable resources for heating and electricity. The measure was adopted in 2010 and had as main purpose to encourage the small consumers to meet their consumption needs by using alternative resources of energy. In return, they are paid by the electricity suppliers for the energy they generate by using renewable resources and for the energy they export to the grid if they do not consume it (Ofgem, 2011). A study conducted by the International Energy Agency showed that the feed in tariff charge is the most effective measure in supporting the use of renewable resources if this is applied and monitored correctly (IEA, 2008).

c) Renewable obligation/Green certificates

This charge is supporting renewable energy use as well, being applied since 2002 on the UK energy market. Through this tax, the government forces the suppliers to buy Renewable Obligation Certificates, in order to provide a part of their electricity from renewable resources (Ofgem, 2014). The tax may be found under other names as well, such as green certificates, renewable energy certificates, etc.

d) Premium tariff

The premium tariff is similar with the feed in tariff tax, the difference between the taxes being that the premium tariff does not apply the same fixed unit price for the whole contractual period but adds a charge on the spot-market electricity prices (International Renewable Energy Agency, 2012).

The table below shows a centralization of the taxes applied in each member country of the European Union in order to support the use of renewable resources.

**Table 1 – Taxes applied across EU to support renewable resources**

Country	Type of tax
Austria	Feed in tariff, subsidies
Belgium	Green certificates and priority of use of renewable energy
Bulgaria	Feed in tariff, subsidies
Croatia	Feed in tariff
Cyprus	Subsidies
Czech Republic	Feed in tariff, subsidies and priority of use of renewable energy
Denmark	Premium tariff
Estonia	Premium tariff
Finland	Feed in tariff
France	Feed in tariff, tax benefits
Germany	Feed in tariff
Greece	Feed in tariff, subsidies, tax exemptions
Hungary	Feed in tariff, priority of use
Ireland	Feed in tariff
Italy	Feed in tariff, priority of use
Latvia	Feed in tariff
Lithuania	Feed in tariff, priority of use
Luxembourg	Feed in tariff, subsidies
Malta	Feed in tariff, priority of use
Netherlands	Premium feed in scheme
Poland	Tax reliefs
Portugal	Feed in tariff
Romania	Green certificates, priority of use
Slovakia	Feed in tariff, priority of use
Slovenia	Feed in tariff, premium tariff, subsidies
Spain	No support schemes in place
Sweden	Green certificates, subsidies
United Kingdom	Feed in tariff, renewable obligation, climate change levy

Source: <http://www.res-legal.eu/search-by-country/>

As shown in table 1, almost all of the EU Members have in place different taxes and policies in order to support the use of renewable resources. Realizing the potential of renewable resources exploitation, EU Member States have implemented a number of mechanisms to support investments in this area based on fiscal relaxation, tax refund and compensation costs for renewable energy production.

### 3. RENEWABLE RESOURCES – FACTS AND FIGURES

The evolution of the renewable resources sector at the European level is better shown by the analysis of different statistics in the area. As the main objective of EU is the expansion of energy production from renewable resources in order to reduce dependence on imported fuels and reduce CO2 emissions, the main indicators that we are going to analyze are:

**Table 2 - Total renewable resources evolution EU27 (Billion kWh)**

Type of renewable resource	2007	2008	2009	2010	2011
Hydroelectric	306.743	323.708	324.927	363.292	303.665
Geothermal	5.722	5.737	5.557	5.612	5.87
Wind	104.346	119.474	133.031	149.112	176.281
Solar, tide and wave	4.296	7.965	14.618	23.614	46.502
Biomass and waste	103.868	110.342	124.512	142.374	151.246
<b>Total Renewable Resources</b>	<b>525.0254</b>	<b>567.226</b>	<b>602.6446</b>	<b>684.0039</b>	<b>683.5638</b>

Source: <http://www.eia.gov/>

As shown in the table, the electricity generated from renewable resources has kept a growing trend in the last few years across Europe. Most of the electricity comes from the exploitation of hydroelectric resources, followed by wind and biomass.

**Table 3 – Share of electricity coming from renewable resources in total consumption EU28 (%)**

Year	2005	2006	2007	2008	2009	2010	2011	2012
EU28	14.8	15.4	16.1	17.0	19.0	19.7	21.7	23.5

Source: <http://epp.eurostat.ec.europa.eu/>

The percentage of the electricity coming from renewable resources has registered also an ascending trend in the last few years, in 2012, 23.5% of the total electricity consumption coming from renewables.

**Table 4 – CO2 emissions evolution EU 27 (Million Metric Tons)**

<b>Year</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>
EU-27	4257.65355	4191.26404	3866.56662	3940.24239	3838.54976
Austria	72.57579	71.18608	65.58184	69.30094	67.18218
Belgium	141.71804	154.74387	132.74756	136.2484	131.06315
Bulgaria	51.89924	50.61403	42.52315	45.58302	52.44446
Cyprus	9.32367	9.80452	9.22543	8.86668	9.50276
Czech Republic	103.5454	99.10063	92.09819	94.68667	92.39661
Denmark	56.87549	54.21517	49.30729	45.8771	46.66476
Estonia	19.99652	18.86217	16.13839	19.34796	20.26289
Finland	58.1547	54.85368	51.60949	54.64973	54.05596
France	423.05632	428.5457	386.15036	388.66282	374.32734
Germany	826.7167	823.31124	772.42236	793.30616	748.48561
Greece	109.46711	106.04136	99.82669	92.87872	91.29833
Hungary	56.62752	56.0523	50.94708	51.31713	49.56284
Ireland	45.1305	45.48569	39.31496	38.24152	36.56834
Italy	459.5288	449.74859	407.6301	416.8183	400.93916
Latvia	8.59771	8.05378	7.93639	7.84508	8.47462
Lithuania	17.7792	18.22991	13.50371	14.26175	16.04993
Luxembourg	12.1445	11.96111	11.43675	12.15519	11.86869
Malta	3.10463	3.17696	6.68233	8.00422	6.83
Netherlands	258.10382	249.49727	243.75934	254.8712	252.99593
Poland	295.94881	294.69969	286.47039	304.72272	307.91092
Portugal	59.61391	55.73528	58.40664	54.21015	54.17396
Romania	98.72974	93.92158	78.4657	76.34094	86.18996
Slovakia	37.72669	37.41842	34.44978	35.57277	34.88257
Slovenia	16.92579	17.42004	16.11383	15.98877	15.82996
Spain	387.95157	360.10337	327.80082	312.40183	318.64374
Sweden	56.5168	54.60931	49.8271	59.18913	53.14585
United Kingdom	569.89458	563.87228	516.19096	528.89349	496.79922

Source: <http://www.eia.gov/>

As far as we can see, the European Directive in the renewable energy area brought positive results, as the CO2 emissions have dropped in the last five years and they have to continue to drop



in the future. Maintaining the CO<sub>2</sub> emissions at the lowest level possible is important for the objective of keeping the global temperature increase below 2 degrees Celsius in the coming years. In order to benefit from technological progress and economies of scale, the countries should take into account the possibility of a more rapid growth in the use of renewable energy in the future.

## CONCLUSIONS

Most of the European countries have adopted a national action plan in order to support the use of renewable resources starting with 2010. The European Directive related to the renewable energy market has set a binding target that, by 2020, a proportion of 20% of EU energy consumption to come from renewable energy. The goal was broken down into secondary national objectives, taking into account the different starting points of Member States. In addition, all Member States must ensure that, by 2020, 10% of fuels used in the transport segment comes from renewable sources. The directive also defined different mechanisms which Member States may apply to achieve its goals (support systems, home security, joint projects, cooperation between Member States and third countries) and sustainability criteria for biofuels.

In the last couple of years considerable progress has been made in this area. The renewable energy market has been developed and investments in the area began to grow significantly, the investors being attracted mostly by the existence of programs that support the adoption of alternative energy solutions, subsidies, access to European funds, etc. Investments in the area have also created jobs and improved energetic efficiency of the countries. In a constructive approach private individuals and companies concerned should make further efforts to encourage the authorities so that they act in a more transparent way and to adopt measures to promote practical application of renewable energy in order to achieve the European targets.

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