The Development of Electricity Market in the European Union and the Legislative Framework

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Abstract: - The article gives an overview of the legislative framework at the EU level, describes the market operation, pointing out possible measures and activities, needed for the creation of a fully liberalised electricity market. Physical flow of electricity through the supply chain, from generation, transformation, distribution and supply to customers is described. Mechanisms to support preferential electricity production from some promising energy transformation technologies and possible solutions applicable for ensuring the use of renewable energy sources for production of electricity are discussed.

Key words: - EU - Energy market, Electricity market, Legislation, Renewable energy sources, Production of electricity

1 Introduction

In the past decade, electricity generating industries dealt with major changes due to the changes brought about by the liberalisation of the internal electricity market in the EU.

Liberalisation of the internal electricity market has influenced national electricity guidelines, the operation of the key local actors, the terms directly affecting the production of electrical energy; consequently, new opportunities opened up for the investors and the supply of energy is more safe, because power exchange regulates the supply and demand market. Electricity is now a market commodity, with a few distinctive features, because of which the market differs from a regular commodities' market.

A common EU energy policy is set up at the union level. By opening up European energy markets to competition Europe's citizens and industries have gained many benefits: more choice, more competition to keep prices down, better service and improved security of supply. To liberalise energy in Europe was necessary because of the following:

- the increased import dependence;
- the need for new investments (new production technologies);
- stocks of energy products are only in some countries (half of the gas used in the EU is imported from Russia, Norway and Algeria);
- increasing prices of oil and gas;

- energy products demand is increasing (it is expected that by 2030 the energy demand and CO₂ emissions will increase by approximately 60%);
- global warming due to emissions of greenhouse gases (the Earth's surface is warmer for 0,6°C; if we don't act appropriately, the Earth' surface will warm for another 1,4 to 5,8 °C),
- the EU energy markets are not yet liberalised to the extent to be completely open and competitive (to achieve the goal, the interconnection has to be improved, efficient legal framework established and implemented at the national level, as well as EU rules on competition respected).

The goal of the EU is to achieve competitiveness through a global and open, fully integrated energy market which would contribute to growth of the economy, development of technologies and opening of new workplaces; consequently, the consumers would benefit from secure, reliable and competitive energy.

Energy landscape for the 21st Century is characterised by the global economic region in ensuring security of energy supply and stable economic conditions; implementation of effective measures against climate change is interdependent and sustainable, competitive and reliable energy is one of the cornerstones of our daily life.

2 Energy Market

The goal of sustainable, competitive and secure energy can only be achieved by fully opened and competitive energy markets, based on competitive companies, which work not only as national actors, but are pan-European competitive. Only fully opened markets and the absence of protectionism can help the EU to deal with the current energy challenges. Only through a common and competitive European electricity market lower prices of energy can be achieved, the security of supply can be increased and the competitiveness improved, consequently leading to increased energy efficiency.

Therefore, the EU energy policy aims at achieving the following goals:

- sustainability;
- development of competitive renewable energy sources and other sources;
- the use of energy with low carbon content, especially alternative fuels;
- decrease of energy demand;
- competitiveness;
- to ensure the opening up of energy markets will benefit the consumers and the economy as a whole, at the same time encouraging the investments into producing pure energy and achieve energy efficiency;
- reduce the impact of higher energy prices on the economy and EU citizens;
- maintain the leading position of EU by developing energy efficient technologies;
- to increase the security of supply in the view of increased dependence of the EU from imported energy.

In the past, the national energy markets were separate "islands" within the EU, where the supply and distribution of energy were in the hands of monopolistic companies. EU has adopted a number of measures in order to establish a common internal energy market. The goal of achieving a common market aims at providing a real choice for the consumers, EU citizens as well as companies, new business opportunities and cross-border cooperation. The EU in this manner encourages competitiveness with means to connect isolated networks and means to improve cross-border connections between the EU member states as well as with supplying countries.

The electricity market can only operate if:

- the market ensures enough electricity;
- there are several suppliers and consumers on the market;
- the transmission and distribution networks ensure a satisfactory coverage and secure and reliable operation;
- the network operators enable all consumers access to networks without discrimination and under same conditions;
- the prices for access to networks are set up by an institution, independent from the interests and influences of actors, operating on the market;
- the disputes, arising on the market due to a discriminatory treatment of interested parties, based on the access to network, are resolved by an independent institution;
- the suppliers supply the energy under beforehand known conditions;
- the protection of the consumers and competition is ensured.

2.1 The concept of energy policy

The main concept is obviously to pursue the energy production and supply to become market activities in a highly transparent business environment, in which the barriers and market distortions shall be removed to the maximal extent. The networks shall be operated independently from the market participants, throughout the EU as one single network. Regulators shall be coordinated and have the powers to regulate the cross border issues as well. And finally, the energy sources from third countries shall be a part of the external policy at the EU level.

In such a market oriented business environment other policy goals are also expected to be supported by market based mechanisms. The energy policy enables additional support for renewable energy sources (RES)[1].

Goal	Sustainability	Security of supply	Competitiveness
Target measure	Reduction of 2°C of the global temperature increase	Diversity of fuel mix, RES, energy efficiency, single European network, sufficient gas import	Well functioning energy markets, reasonable energy prices
Some implications	Emission limits and measures at a national level, possible redirection of support mechanisms for RES and energy efficiency	State energy policies, regulator's measures to TSOs, operational security rules, external relations, other	Further unbundling requirements, more market monitoring, competition protection measures, cross- border regulation, other

Table 1: Some goals and implications of the common energy policy [2]

There are, however, some challenges to the external relations to ensure the appropriate gas sources. Most of the imported gas originates from non-EU countries. This requires also some tolerance and exemptions for the gas transport infrastructure, particularly for a new one. Scarce capacity of the gas pipelines and low diversity of sources are among the main risks for short and long term security of supply. Moreover, the electricity sector undergoes a period of low investment activity as well, since there is a motivation for particularly vertically integrated incumbents not to invest into new cross border capacities in order to keep the cross border trade and influence limited. Low investment intensity is also a serious concern for the long-term electricity generation adequacy.

The renewable energy sources for electricity generation may, intensively supported, significantly increase to the level of 20% until 2020 [3] or above, but the rest of at least ³/₄ of electricity will originate from conventional fossil and nuclear sources. Therefore environmental and safety requirements together with correspondent technology development is foreseen [4, 5].

2.2 The relevant secondary EU legislation (Directives and Regulations)

On 23rd April 2009 Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources [6] and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC was adopted.

The Renewable Energy Directive establishes a common framework for the promotion of energy from renewable sources. It sets mandatory national targets for the overall share of energy from renewable sources in gross final consumption of energy and for the share of energy from renewable sources in transport. It lays down rules relating to statistical transfers between Member States, joint projects between Member States and with third countries, guarantees of origin, administrative procedures, information and training, and access to the electricity grid for energy from renewable sources. It establishes sustainability criteria for bio fuels and bio liquids (Article 1, defining subject matter and scope).

On 13th July 2009 Directive 2009/72/EC of the European Parliament and of the Council concerning common rules for the internal market in electricity and [7] repealing Directive 2003/54/EC was adopted.

This Directive establishes common rules for the generation, transmission, distribution and supply of electricity, together with consumer protection provisions, with a view to improving and integrating competitive electricity markets in the Community. It lays down the rules relating to the organisation and functioning of the electricity sector, open access to the market, the criteria and procedures applicable to calls for tenders and the granting of authorisations and the operation of systems. It also lays down universal service obligations and the rights of electricity consumers and clarifies competition requirements (Article 1, defining subject matter and scope).

On 13th July 2009 Regulation (EC) No 714/2009 of the European Parliament and of the Council on conditions for access to the network for cross-border exchanges in electricity [8] and repealing Regulation (EC) No 1228/2003 was adopted.

The Regulation aims at:

- setting fair rules for cross-border exchanges in electricity, thus enhancing competition within the internal market in electricity, taking into account the particular characteristics of national and regional markets. This will involve the establishment of a compensation mechanism for cross-border flows of electricity and the setting of harmonised principles on cross-border transmission charges and the allocation of available capacities of interconnections between national transmission systems;
- facilitating the emergence of a well-functioning and transparent wholesale market with a high level of security of supply in electricity. It provides for mechanisms to harmonise the rules for cross-border exchanges in electricity.

On 13th July 2009 Regulation (EC) 713/2009 [9] of the European Parliament and of the Council establishing an Agency for the Cooperation of Energy Regulators was adopted. This Regulation establishes an Agency for the Cooperation of Energy Regulators. The purpose of the Agency is to assist the regulatory authorities in the Member States and, where necessary, to coordinate their action.

3 Liberalisation of the energy market

Through introduction of free movement of goods and services in the energy field, the European Union has decisively influenced the energy markets worldwide.

The basis for electricity market represents the Directive 96/92/EC [10] of the European Parliament and of the Council, henceforth referenced as the first electricity directive. It introduced customer choice for the large customers in terms to be able to choose their supplier, on the basis of a transparent and non-discriminatory network access.

The Directive established common rules for the generation, transmission and distribution of electricity. It laid down the rules relating to the organization and functioning of the electricity sector, access to the market, the criteria and procedures applicable to calls for tender and the granting of authorizations and the operation of systems.

The Directive was transposed into national legislations of the Member States in order for the markets to gradually open up.

The Electricity Directive introduced customer's choice for large customers in terms to be able to choose their supplier, on the basis of a transparent and non-discriminatory network access. Nevertheless, there were obstacles that still hindered the achievement of a fully competitive internal market, obstacles related to access to network, tariffication issues, different degrees of market opening between Member States in both sectors, and furthermore, access to storage and interoperability between systems in the gas sector. The internal market has not yet reached the maturity due to several reasons, among them limited capacity in cross-border paths. After a few years of experience the understanding prevailed that full market liberalisation is needed together with a higher degree of unbundling and compulsory network service regulation, which led to the adoption of Directive 2003/54/EC for the internal market in electricity[11] and Regulation 1228/2003 on conditions for access to the network for cross-border exchanges in electricity [12]. The new legislation enhances the role of National Regulatory Authorities and provides a more detailed framework for the EU internal market in energy.

The goals to be achieved by opening up the electricity market are:

- deregulation:
 - abolition of the monopoly of dominant national companies;
 - market openness and the absence of protectionism;
 - transfer of market power from production companies to network operators.
- liberalisation:
 - option to choose the supplier of electricity and other services (supply-side competition);
 - reduction in electricity prices for consumers.

The conditions of liberalisation of the electricity market are:

- supply-side competition;
- competition on the consumer side:
 - suppliers supply under transparent conditions known in advance,
 - consumer protection and competition is guaranteed.
- transparent and non-discriminatory access to network.

Currently, very little is known about the consequences of energy market liberalisation, which aims to achieve more efficient production and hence lower prices of electricity. This objective may include two opposing effects, on the one hand, electricity is cheaper and maximizes the consumption, leading to an increased impact on the environment.

The declared main goals of liberalisation were to increase competitiveness in the market, decrease or at least stabilize electricity prices at relatively low levels, and the improvement of services.

4 The structure of the market and market operation

4.1 The structure of the market

One of the main preconditions for market operation is its transparency. Transparency of the market can be achieved if the information on the electricity prices are published, e.g. on the web portals.

Providing information on the web portal is suitable due to fast changes appearing on the energy market. It represents an easy way to adjust contents and for upgrading information, for consumers as well as suppliers. It is divided into:

- information portal collection of web information on energy sector [13],
- business portal information on electricity exchange (technical information, environmental information, economic indicators, political information [14], influencing the prices of energy)

The role of market participants is presented in figure 1, describing the physical flow of energy.



Fig. 1. Physical flow of energy [15]

The networks do not operate by themselves; this is done by legal entities (transmission and distribution systems operators). The transmission network enables the supply of energy from the producer to the distributer and their interoperability. The distribution network serves for distributing energy to consumers.

4.2 Operation of the market

The European Commission annually reports on the market operation in the Member States on the basis of the reports, submitted by national regulators, which are obliged to report on the market operation and the energy sector as a whole. In 2005, the European Commission defined the substantive matter of the reports for the first time.

The report needs to provide information on the quantity of electricity, on the operation of retail and wholesale market, on the number of switch of suppliers. Furthermore, the report provides detailed information on the electricity prices and network charges for consumers, information on dominant positions on the market and possible limitations of the market. A system of reporting is established, which enables detailed comparative analysis of the parameters, typical for the market and the prices of public services, will be possible to conduct on the basis of information provided in the reports.

Current reports encompass the review of electricity market in all the member states; on the basis of the information provided, five major critical areas that hinder the development of the market can be established: concentration of the market, vertical foreclosure, lack of interoperability of national markets, lack of transparency and pricing. Analysis of vertical foreclosure structures showed that the current level of unbundling of network operators to suppliers of electricity is not sufficient, since it still has a very strong impact on the operation of the market. Dominant companies do not invest enough in the network, since they are not motivated; therefore, the long-term security of supply is endangered. In addition, the entry of new players into the market is disabled, thus reducing competition in the market by discrimination or preferential treatment of their own supplier. There is also a strong influence of commercial interests of suppliers seen in development decisions and planning of networks, which has an extremely negative impact on the reliability of supply.

4.3 Market organiser

One of the basic conditions for opening up the electrical power market is trading on an organised electrical power market, which is organised by a legal entity – the market organiser (Figure 2).

Establishing a power supply market organiser was one of the provisions provided for by the Slovenian Energy Act, and at the same time represented one of the principal conditions for opening an electrical power exchange. Exchanges are a market mechanism which attempt to stimulate competitive conditions and introduce transparency to the market either voluntarily or in a partly coercive manner. In ideal circumstances, day-ahead market exchanges of electrical power facilitate economical efficiency both on a short-term and long-term basis. In Slovenia, the electrical power exchange activity was entrusted to Borzen, d.o.o., a subsidiary of Elektro-Slovenija, which was founded at the start of 2001.



Fig. 2. Market organiser

5 The Production of Electricity

Power engineering plays a decisive role in economic and social development of the EU and in the quality of life of its residents and consumers. It is the key element of the European economy and the energy stability. The continuing concern is to provide sufficient electric power generation capacity of electricity and establish an adequate distribution network. It is important that the production and the demand for electricity are balanced. The European Union has to face two challenges to ensure the adequacy of electricity production in the future.

It needs to promote the green (clean) energy, and provide sufficient electricity capacity at a reasonable price; it needs to ensure the security of electricity supply by using different primary energents (fuels).

In short, power engineering in the European Union is facing a great challenge and brings new opportunities for investment and development.

The new EU energy policy introduces crucial changes in the production of the electricity.

The demand to decrease CO_2 and greenhouse gases has a direct influence on production capacities of electricity.

With regard to current trends and electricity demand, an increase in the consumption of electricity is expected by 2030, consequently leading to an increased demand for additional production capacities. Until now, the production of electricity was equivalent with its consumption. However, by 2020 the EU's demand for energy will increase by 200 GW (depending on the price of oil) in comparison to 2007.

The use of different technologies is key to security of electricity supply and has to be taken into account when examining the suitability of infrastructure for the production of electricity in the EU. Generally, the production of electricity in the EU was from different energy resources, as shown in Figure 3. In the future, generation capacity by technology is expected, as shown in Figure 4.



Fig. 3: Electricity generation capacity according to technology in Europe [16]



Fig. 4. EU27 Generation capacity by technology (2006) [17]

That in the future electricity needs in Europe are covered, large investments in new production technologies with low carbon emissions are required. If the investment is now planned by the operators, approved and successfully implemented, the demand for electricity is met. However, experience shows that only a small part of investments planned is carried out on time. Investment in electricity supply are complex, capital-intensive, with long-term realisation. The time in which they become profitable is highly dependent on several external factors and conditions, making decisions on investment very difficult.



Fig 5.: The planned construction of electricity production units

Current investments are focused primarily on gas powered plant, and to a lesser extent in the wind power and cogeneration of electricity and heat. This development intensifies the different technologies of electricity generation and reduces greenhouse gas emissions. The trend is also dependent on gas supplies from third countries. A large part of renewable energy is desirable, not only to reduce greenhouse gas emissions, but also because of different electricity generation technologies and because of reduction of dependence on imported gas. Therefore, the new energy policy only provided some investments in gas powered plants after 2010.

Planned future investments show envisaged movements to the use of different fuels and resources and the trend of building smaller decentralized units, which would strengthen the capacity and reliability of electricity production in the European Union.

5.1 Renewable energy sources and electricity

Renewable sources for electricity production include:

- bio energy (especially wood biomass);
- hydro energy;
- solar energy;
- wind energy;
- geothermal energy;
- tidal energy.

The use of renewable energy sources is associated with the use of energy in various activities: the burning of wood for heat, use of hydro power for transportation and for different activities (mills), wind (wind mills, water pumping), and in some cases, even solar power. The use of renewable energy sources was reduced due to the period of discovery of fossil fuel (coal and oil), which has led to significant climate change and the need to reuse them.

Biomass with 6% share represents the largest renewable energy source. The highest use in 2006 was registered in Germany - as much as 18% of the total biomass in the EU. Exploited by the 26 countries of which Slovenia was at 23 place with 0.5%. Figure 6 represents its most important renewable resource that is in relation to forest areas, which comprise 50% of the Earth's surface. Electricity from biomass represents 2% of total electricity consumption in the EU. In Germany and Sweden the use of biomass is well researched, so that it applies even for driving buses.

Biomass consumption in some countries in ktoe (thousand tonnes of oil equivalent) is shown in Figure 6.



Fig 6.: The use of biomass in some countries in 2006

Hydro energy includes energy produced in hydro electric power plants and energy of waves and tidal power; it is for the benefit of all 27 EU member states. Also in the field of wave energy utilisation, the EU has the world's leading position. It is also important to note that in recent years, particularly the share of small hydroelectric power plants is increasing. Slovenia is rich in water resources and has the 14th place in the EU in terms of electricity production - Figure 7

In the use of solar energy the leading country is Germany, as shown in Figure 8. In Slovenia, the use of solar energy expanded only after 2006 and has progressed to date.



Fig. 7: Leading countries in use of hydroelectric energy in 2006



Fig. 8: Leading countries exploiting solar energy in 2006

Wind energy (data for 2006) was the most exploited in Germany; Spain, in recent years, strongly follows Germany. Slovenia did not produce wind energy in 2006 and is the only country besides Malta that does not produce wind energy today, although based on meteorological models Slovenia has the potential to do so.



Fig. 9: Leading countries exploiting wind energy in 2006

5.2 The comparison of the use of renewable energy sources in the EU and in non-EU countries

Figure 10 shows the use of renewable energy sources in the world. The graph shows that the U.S. exploits renewable energy sources the most, by 20%, followed by the EU, China and Japan and then other countries with consumption of less than 5%.



Fig. 10: The use of renewable energy sources in the EU member states and non-EU countries in 2006

In the EU, wind energy exploitation boosted in the past years. Only in 2008, the EU has set more wind power plants than any other power plants. Statistics of the European Wind Energy Association (EWEA) show that wind energy in 2008 accounted for 43% of the total capacity for electricity production, thereby outpacing the resources like gas, coal and nuclear power. On average, every working day 20 wind turbines were constructed, which provided, inter alia, 160,000 jobs and required 11 billion Euros of investments. Germany and Spain are leading in the prevalence of wind energy. Most progress is reached in Great Britain, Italy and France. Great Britain is also the leading country in the world by the number of coastal power plants.

It was also the 2008 that was the record year in the utilisation of solar energy and photovoltaic. In Germany, which was already a leader in 2006, the number of newly constructed solar thermal systems has doubled, which means that the country has 1.25 million today. Despite the crisis, also in 2010 major investments in solar systems are expected, mainly due to attractive government grants.

The share of energy produced using water resources has also increased, mainly due to the construction of small hydropower plants. Europe has maintained its leading position in the field. A big step in this is done, France - French EDF energy community with the firm Open Hydro Group has started to build the first underwater hydroelectric power. This is a pilot project to be completed by 2011.

Wood biomass as an energy source is still the most widespread in France and Germany, but the growth in this segment is currently slow, mainly due to high temperatures and forestry crisis. An increase in utilisation of geothermal energy is also noticeable, where Italy still has a leading position.

6 Conclusion

Despite the comprehensive EU energy legislation, in reality, the operating of the specific markets in the EU member States is reduced to the operation of the sub markets; wholesale markets are mainly bilateral, but in most states, trading on an organised electrical power market is established.

For the operation of submarkets to become unified, firstly, a harmonized functioning of the organised electrical power markets is necessary; further on, the transmission system operators need to harmonise countervailing markets, which leads to a full liberalisation. The main goals of liberalising the market are:

- all suppliers operate on one single market;
- an increase of production and lower prices;
- security of supply;
- all companies have equal access to the energy market;
- environmental protection requirements are considered; and
- lower energy dependency.

All of the above requires a sustainable development approach, accelerates competitiveness and provides security of supply, leading to a new energy era and represents the foundations of our every-day lives.

In the time of economic and financial crisis, it is simply unacceptable that the European consumers and companies suffer the burden of an ill-functioning energy market, which can be seen from:

- lack of information provided by electricity transmission system operators;
- inadequacy of network capacity allocation systems to optimise network use for electricity transmission in member states;
- lack of coordination and cooperation across borders by electricity transmission system operators and national authorities;
- lack of effective enforcement action by the competent authorities in Member States in case of violations of the EU regulations;
- the persistence of regulated prices;
- the absence of adequate dispute settlement procedures for consumers at national level.

Therefore, measures respecting EU legislation are needed and measures ensuring fair prices to citizens and industries.

The measures needed are of a technical nature:

- new rules to avoid discrimination are needed;
- it is also important to have the European wide regulation authority to facilitate cross – border electricity trade;
- transparency is essential to market functioning;
- common minimum, binding network security standards are necessary.

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