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MASTER'S THESIS

THE INFLUENCE OF REGULATION AND LIBERALIZATION OF THE ENERGY MARKET ON ELECTRICITY PRICES

Sarajevo, October 2013 ELMA IMAMOVIĆ

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INTRODUCTION

The research theme of this Master thesis is the consideration of appliance efficiency of the reform processes in electricity sector with the aim of establishing the effects of liberalization process on the electricity market with a distinct emphasis on the effect of liberalization of electricity prices fluctuations on the market.

According to Blumsack, Lave and Apt (2008, p. 1), "restructuring of the electricity industry was expected to improve the operating efficiency of electricity generators, leading to lower production costs and electricity prices. Most studies conclude that there have been some efficiency gains, but the subject of whether electricity prices have fallen has been contentious."

Liberalization of electricity market followed by electricity sector reconstruction and ownership transformation of electricity companies needs to provide positive economic effects on all contributors in electricity market. The expected economic effects of electricity market liberalization apply to lowering of electricity prices, increase in sector investments, establishing reliable and safe sources of electricity supplies, and energy dependence of states decrease. The theme of the research is largely restricted to measurements of electricity sector liberalization impact on electricity prices in European Union countries and Bosnia and Herzegovina.

The main idea of electricity market liberalization is separation of transmission and distribution activities of electricity, that have natural monopoly characteristics, from production and supplying activities, that operate in market oriented conditions.

The aim of the reform processes in electricity sector is the creation of liberalized market of electricity, that is – introduction of competition on the market. Reforms of electricity sector in B&H imply the passing of the legal acts, setting up institutions needed for optimum functioning of electricity system, reconstruction of electricity monopoly in B&H and privatization, by which their sustainability, efficiency and competition will be established.

Electricity sector in Bosnia and Herzegovina has been facing with the following challenges (Jenko, 2007, p. 1):

- Reconstruction and modernization and in the post war era
- Unification of the fragmented electricity system
- Market oriented reforms aiming to join Regional electricity markets and then to integrate with the European Union electricity market.

"Bosnia and Herzegovina has been a net exporter of energy ever since the war. With many local industries destroyed or in the reconstruction process as a result, the capacity and

output of the power plants exceeded actual domestic demand." (Studija energetskog sektora, 2008, p. 15). At this moment, production capacities have outgrown domestic needs, thus it is exported to Croatia, Slovenia, Serbia and Montenegro. When it comes to natural resources, B&H has significant supplies of brown coal and lignite, which are used as fuel for thermoelectric power plants and large and unused hydro potential.

According to data from „Project energy efficiency consultancy" implemented by GFA Consulting Group and Integration (2010, p. 21), there are three vertically integrated electric utilities in B&H and under their authority are production, transmission and distribution:

1. The first company is Elektroprivreda of Bosnia and Herzegovina (hereinafter EPB&H). EPB&H is a public company for electricity production, distribution and supply. It is the largest electricity company in B&H by capital value, installed generating capacities, total electricity output and supply, with 660.000 customers. The EPB&H operates in FB&H. 90% of its capital is owned by the Government of FB&H, and the remainder is held by private investment funds and small shareholders.
2. Elektroprivreda Hrvatske zajednice Herceg Bosne (hereinafter EPHZHB). EPHZHB starting from 2004 operates as a joint stock company with 90% state-owned stake and 10% of shareholders' stake. Today EPHZHB has about 180.000 customers. EPHZHB operates in the area of FB&H.
3. Elektroprivreda of Republika Srpska (hereinafter EPRS). EPRS was founded as a company for production, transmission and distribution of electricity and coal, and operation of the electricity system of Republika Srpska. EPRS operates in the territory of RS and has about 500.000 customers.

The three companies are essentially monopolies as they do not compete with each other. Each of them is producing electricity for their own ethnically focused territory – not intruding on anyone else's area, except for the Brčko District, which is being served by EPRS.

"The regulatory function is covered by three Regulatory Commissions: one state and two at entity level. The transmission function is unbundled from the three electricity companies and a single Transmission Company has been established. Unbundling of generation and distribution of the three electricity utilities is underway. Separate accounting for generation and distribution is established. In Entity Republika Srpska legal unbundling is completed. The Independent System Operator represents BH in regional ITC mechanism (Inter TSO Compensation). Recently ISO became associated member of ETSO (European Transmission System Operators)." (Jenko, 2007, p. 2).

The research hypothesis:

1. *Market liberalization and the introduction of competition in the electricity market in European Union countries does not provide long term electricity price lowering.*
2. *De jure liberalization of electricity market in Bosnia and Herzegovina does not affect on the lowering of electricity prices for users.*

In the uncertain conditions we live in today the significance of energy is growing rapidly; apart from it being one of the most important necessities its relevance to the growth and competition in the world among nations is increasing more and more every day. The entire economic progress of a country lies on the secure energy supply which has a key role in upholding absolute national security and the accessibility of energy sources and efficiency of its infrastructure, which also makes a significant contribution (Vukić, 2009, p. 19).

Even though there were many delays and negotiations regarding the energy policy and the liberalization of the electricity market of the EU, by signing the Stability Association Agreement with the EU in 2008, Bosnia and Herzegovina is already on its way to becoming a member of the EU. B&H, along with another 15 contracting parties from South East Europe has signed an Energy Community Treaty with EU obliging itself to a number of EU directives in the goal of someday integrating B&H's electricity market to the internal electricity market of the EU by establishing regulatory and market framework for its liberalization. According to Rozić (2009, p. 4) these new commitments gave a much needed impulse to start the reformation of B&H's energy sector which started in 2000.

According to von Danwitz (2006, p. 423) "the terms "liberalization" and "regulation" of electricity markets have devolved into expressions of largely inflated use, which proves to be the safest and fastest way for those terms to become meaningless. But, properly understood, these terms remain meaningful, reflecting a fundamental change in the legal framework designed for energy markets; a change which started in the U.S. and which now, after some delay, is occurring in Europe as well."

For this purpose, liberalization refers to the abolition of the right to a monopoly which was appointed to European and U.S. – American suppliers as a mean of protection against competition. Also, the term regulation which is used here has a double meaning. It primarily refers to measures taken or put into action in order to ensure the presence of competition in a liberalized (energy) market (Von Danwitz, 2006).

Secondly, the regulation makes understanding the fundamental importance of a secure and reliable energy supply utilized for public welfare easier. This type of regulation doesn't leave the energy supply depending merely on the demand and possibilities of supplying. Instead, a specific set of standards which take into account the services of general interest and the security of supply apply when it comes to implementing the imposed regulation. This way, private market development is restricted. In accordance with this, the liberalization of a certain market cannot be carried out without regulation, which is also a result of this very process. However, even though regulation is indeed necessary for the process of market liberalization, the question of which exact administrative form of

regulation to utilize is still open. The desired regulatory aims may be achieved in several different ways (Von Danwitz, 2006).

Liberalization brings with it a fundamental change to the entire energy sector. On the other hand, due to liberalization being a complicated process which carries many challenges and risks, it may, if not executed properly, lead to serious mistakes.

The monopolistic structure of the energy market, which has been present for quite a period of time, has changed in the recent opening of the market. Along with the reduction of greenhouse gas emissions, the development of energy services was one of the main expectations added to another expectation lying in the introduction of a rise in the competition – price decrement (Bonneville & Rialhe, 2005).

The liberalization of the electricity market, representing a reform of the electricity industry, has one main, fundamental declarative goal: increasing the level of competition in economy by means of raising the efficiency of the electricity sector. The following goals were set when it comes to the liberalization of the electricity market: a decrease in the prices of electricity, bringing the service to a higher level, making the differences in prices among countries smaller, making it possible for all customers to choose their own suppliers and an overall increase of efficiency in the sector by minimizing necessities such as the construction and maintenance of reserve capacities (Tominov, 2008).

This work presents an investigation and analysis of the level to which the expectations of the liberalization of the electricity market have been met. It surveys not only the level of achievement of the goals initially set when it comes to liberalization, such as the transition of the electricity industry from a monopolistic organizational structure to a more efficient, competitive structure but also the probability and possibility of achieving all the goals it proposes. By assessing the cost-benefit ratio, one can easily see that the liberalization of the electricity market will not bring a decrease in the prices of electricity which is its primary goal and also the primary reason for initiating this process.

Another goal which has not been fulfilled is the leveling of prices among countries. Even after the process is implemented prices among countries continue to largely differ. Also, in terms of the organizational structure of the electricity industry, the intended transition from a monopolistic structure to a competitive one can also not be detected. There has however, been a positive shift regarding the improvement of the quality of services, bringing to a minimum the need for the construction and maintenance of reserve capacities which consequentially leads to an increase in the efficiency of a certain sector and also in the formal opening of the markets (Tominov, 2008).

The main purpose of the thesis is to describe how do liberalization and regulation influence on prices of electricity. As an example we will use European Union countries and Elektroprivreda B&H. Along with current issues and changes which may have an impact on the energy needs and energy consumption not only in the region, but also worldwide

this thesis also identifies and analyses the potential return of the created impact of the energy sector of Bosnia and Herzegovina.

The countries of this specific region, including Bosnia and Herzegovina, are in the process of changing the structure of the electricity markets by restructuring, liberating and deregulating. Attempting to separate the activities which concern the transmission and distribution of electricity, which by their nature alone have a monopolistic structure, from the activities of producing and supply energy, which on the other hand operate in market conditions, is the general idea of liberalization.

Liberalization of the market grants certain novelties to the participants of the private market such as new economic freedoms; the question of restricting or in fact absolutely eliminating these freedoms by means of administrative regulation is the subject of an intense debate present in academic circles. Even more so, the transient regimes given temporary power over the newly liberalized energy markets in order to restore undistorted competition may just as well become a permanent system of governmental regulation, warn market experts. Arising with these concerns are the following fundamental questions: are freedoms granted as a part of the process of liberalization supported in a sufficient manner by the bureaucratic burden of regulations? Does it, by supporting the use of newly given freedoms in a positive way, interfere with the substance of the very market? And does the base premise of the market liberalization process become questionable due to this sort of regulation making an unjustly encroach on economic liberties? (Von Danwitz, 2006).

The main goal of this research is to analyze the level of success of the process of liberalization in EU countries and Bosnia and Herzegovina, the electricity prices that are present, and to assess the achievements of the Regulatory Commissions for Electricity in B&H when it comes to regulation.

According to the European Commission, the liberalization of the electricity market will affect the reducing electricity prices, securing supply, improving efficiency and developing renewable energy production. Unfortunately, none of the desired goals mentioned have been fulfilled in the past decade during the opening of the electricity market - for instance, the lowering of prices which was expected did not take place – not only for industrial but also residential customers. Another goal which had not been fulfilled was the expected increase in efficiency the market industry was expected to achieve, as well as upgrading of infrastructure which was also left unattended to (Bonneville & Rialhe, 2005).

The entire world has been leaning towards shifting their energy policies in the direction of market liberalization. This research is an attempt to determine not only the conditions under which the implementation of the liberalization of the market is beneficial for all involved, but whether it does in fact lead to an increase in energy efficiency (Bonneville & Rialhe, 2005).

Given that quite a few parameters such as the prices of fuel, the power capacity installed and the reserve margin, must be taken into account when assessing the evolution of prices during the liberalization of the energy market, it is no wonder that this process is very frequently inadequately understood. Bearing in mind that the full liberalization of an electricity market has been shown to lead down both paths – price increase and decrease it is only safe to conclude that liberalization will not, as promised, necessarily lead to price reductions.

The sudden rise of technology has indeed led to a bigger requirement of the coordination of competition. Previous elements of the monopoly, such as system operations, scheduling and dispatch all display a need to be regulated. This, in a certain way, makes the regulator's task somewhat harder. Determining whether certain operations and decisions regarding investment are reasonable and supervising vertically integrated monopolies is one thing, but modeling rules for a several number of different generators, transmission owners, customers and the system operators in order to enable bringing reasonable decisions regarding the market is quite another. For cases which are of more importance, investments lead by the market may not prove to be sufficient. In these cases, central planners and regulators may still be expected to bring decisions regarding the investment in infrastructure. The challenge lies in making an adequate set of criteria by which these decisions will be brought, criteria which are in concurrence with market choices which will not unintentionally lead to the disentanglement of the market (Hogan, 2008).

The method of research will be based on data collected from secondary sources such as the *Ernst & Young Research project on The Case of Liberalization* (2006) and *B&H Energy Sector Study* (2008).

The methodology is designed in a way which ensures a transition from deductive research methods to inductive methods, resulting in solutions applicable to the territory of Bosnia and Herzegovina and European Union. For this purpose, historical methods, analysis of the theoretical achievement and analogue methods will be used, with a view to summing up the experiences of European Union countries in order to draw conclusions which will be helpful to B&H.

Throughout the entire study, cognitive methods will be used in addition to normative, historical and comparative methods used in order to compare process (benchmarking). A few other methods, such as compilation methods, description and comparison will be used in this study.

The method of analysis represents the process of breaking down the more complex concepts to the more simple components and elements which they consist of by using scientific research. This will be used not only for analyzing concepts but also for analyzing models, features and other elements of the research. Detection method refers to the process of determining whether certain facts are accurate or not, and synthesis method is used in

the final stages of discussion with the goal of merging together collected facts with the purpose of creating a proper conclusion.

The method of deduction will be used in order to derive appropriate conclusions regarding work from general knowledge that is already present. The inductive method will be used for the analysis of individual factors such as the prices of electricity which enables us to, by observing certain specifics for individual cases, derive general conclusions which will serve in the process of forming opinions and conclusions regarding the validity of the thesis.

In the first chapter of research the basic concepts of the electricity market are presented. This chapter is focused on defining the concept of the electricity market and electricity as a product.

The development and functioning of electricity market are discussed in the second chapter. Analysis of the functioning of the electricity market included research of differences between electricity companies when they have monopoly on the market and when they do business in a competitive market.

Theoretical aspects of the liberalization of electricity market, problems and effects of the liberalization of the electricity market are subject of the third chapter. According to Financial Times Lexicon's definition "energy liberalization is a political and regulatory process that brings competition into former electricity monopolies. Competition occurs mainly in electricity generation and sales activities. Network activities such as transport and distribution are traditionally regulated. The aim of energy liberalization is to create competitive markets, leading to more efficiency and innovation in the industry."

The fourth chapter presents the term regulation, the forms of regulation of electricity prices and the goals and objectives of regulation. The final part of this chapter presents the Regulatory Commission for Electricity in Federation B&H – FERC as an independent regulatory body, which is a central tenet of the electricity sector reform process in Bosnia and Herzegovina.

The fifth part analyzes the structure of the electricity market of B&H, market development opportunities and specifics of the reform process in the electricity sector. The energy sector is following division of the State which is comprised of two separate entities: the Federation of B&H and the Republika Srpska along with 10 cantons, not including the Brčko District which enjoys a special status. At the energy market 3 separate electric companies operate, all granted licenses to generate, distribute and supply electricity in relation to the structure of the State. All three of the above mentioned companies still have a monopoly on these territories.

Electricity prices, the formation and structure of prices are presented in the chapter 6. This chapter also presents the fluctuation of electricity prices in selected European Union

countries and Bosnia and Herzegovina in the 1996-2007 period, based on which the effects of thus far liberalization process are seen.

1 BASIC CONCEPTS OF THE ELECTRICITY MARKET

Up until recently production, transmission and distribution of electricity have been considered in most of the countries as the natural monopoly. The electricity sector was mainly organized trough vertical connection of companies, whether through monopoly or oligopoly, mainly owned by the state or strictly regulated private ownership, which controlled all the segments involving electricity system.

The things have started to change lately. The electricity industry reform, which started in the 70's (during the last century) in the world, is basically reduced to liberalization and deregulation of the electricity market. From then until now, many countries have approached the electricity industry reform in different ways, with the different intensity and dynamics, but always with the clearly defined main goal: to abolish the existence of electricity companies and trough the competition introduction to enlarge the efficiency, the lowering of costs and the rise of the electricity quality (Hogan, 2008).

It could be stated that electricity is a very special product. Some features make it a unique merchandise, and that special features should be taken into account when creating the electricity market and defining the appropriate system of tariffs.

According to Jenko (2007) some of the important features of electricity are as follows:

- A continuous flow. Electricity is produced and spent in continuity.
- The simultaneous manufacturing and consumption. Electricity is spent in the exact moment when it is produced.
- Inability of storage. On a large scale electricity cannot be stored while still being economically feasible.
- The consumption variability. The electricity consumption or demand is variable with the specific configuration for day/night, during the week or year.
- It's without the known origin. There is no physical way by which the electricity unit (kWh) delivered to the consumer could be tracked back to the producer that produced the unit. This feature makes a special postulate for the measuring and charging system of electricity.
- Important for the community. Electricity is an absolute necessity in the modern society. Every household and every company are connected to the electricity grid.

- Electricity system breakdown risk. Thanks to the technical features of electricity system accidental supplying pauses don't only strike the individual consumers.
- In the matter of electricity grid collapse large areas can be affected[1] (Jenko, 2007).

On all merchandise markets, at some point, a balance between production and expenditure must be set. On the electricity market it has to be a simultaneous balance. Production and expenditure has to be balanced minute by minute, day and night throughout the entire year (Omeragić, 2010).

The classical economic theory is based on the balance between production and demand, and that balance is achieved with a price that is accepted both by the producer and the consumer. However, in the electricity system the extremely simultaneous and continuous change of peak load creates problems (Tominov, 2008).

The pricing mechanism cannot act swiftly enough to balance the production and consumption in reasonable time. The practical consequence is that the price of the electricity need to be determined either before the reasonable time (*ex ante*), or after the reasonable time (*ex-post*).

Because of this there cannot be an electricity market in a reasonable time.

These main features of electricity have a number of effects such as:

- Electricity substations work under full capacity only in times of full system load.
- The various types of power plants with various expenditure structures participate in the complex of manufacturing capacities.
- The electricity prices, and therefore the tariffs, vary depending on the time of production and consumption.
- The differentiating system of the average price in the range of time enables the familiarizing of the consumer with periods of time in which they can spend the merchandise that is offered cheaper and more rational (for themselves and for the system).

2 THE DEVELOPMENT OF ELECTRICITY MARKET

From an economic point of view, electricity is a service which is eligible for purchase, sale and trade. The electricity market, in this case, functions as a system which assists in the process of purchasing such a service, making a link between an auction and an actual purchase; the process of selling by linking offers and actual sales; and the process of short

[1] The great system breakdowns have stricken, for example, New York in 1977 and 2003 with the vast economic consequences.

term trading which is most likely to be carried out in the form of financial or obligation swaps. The price is set in accordance to supply and demand principles through bids and offers. Long-term trades or contracts which are considered to be private bilateral transactions agreed upon between two counterparts and are in this way, quite similar to agreements made when purchasing electricity.

A market operator or a specifically appointed independent entity which is trusted solely with this one task is in charge of clearing and settling the process of making bids and offers, or in other words, wholesale transactions regarding electricity. Although market operators are not authorized to clear trades, they do frequently necessitate knowledge regarding trade so as to maintain generation and load balance. Two types of merchandise which a certain electricity market handles can usually be recognized as power and energy. Power, which is measured in megawatts (MW), is defined as the measured net electrical rate of transfer at any given moment. Energy, which is measured in megawatt hours (MWh), represents the electricity flowing through a point which is metered for a given period (Osmanbegović & Kokorović, 2010).

Markets which handle services related to energy have a net generation output for several increasing intervals which are usually between 5, 15 and 60 minutes. Ancillary services are present in the form of markets handling power related services which are required, managed and paid for by market operators in order to guarantee reliability. According to Osmanbegović and Kokorović (2010), these services comprise names such as spinning reserve, non-spinning reserve, operating reserves, responsive reserve, regulation up, regulation down, and installed capacity.

Furthermore, when it comes to the most of well-known major operators, there are separate markets handling transmission congestion and some of the most common electricity derivatives, such as future electricity supply and options regarding electricity, which are both actively traded. These markets owe the need for their development to the reformation of electricity systems around the world, of which they are a direct consequence. This reformation has often gone hand in hand with the parallel reformation of markets handling natural gas.

Electricity is, by its nature, type of merchandise which is not easily stored but on the other hand must be available on demand. This brings up a problem which cannot be met when it comes to other products, seeing as it is not possible to keep such merchandise in stock, divide it or arrange for customers to queue for it. Even more so as factors such as demand and supply vary on a steady basis.

However, the expected demand for the system across the entire system transmission grid must be met. This is achieved by appointing a transmission system operator as an agency which is in control of the coordination of the dispatch of generating units which fulfill the above mentioned obligation. In the case of a discrepancy arising between the supply and demand, the generators speed up or slow down which will cause the frequency of the system which is usually ranges in between the values of 50 to 60 Hz to increase or decrease (Kukuruzović, 2007).

The system operator operates through either generation or load, by accordingly adding or removing both if the frequency happens to fall outside a range which has been previously established. Furthermore, the electricity flow within a network is determined by the laws of physics. The economic dispatch of generation units is influenced by any electricity which is lost in transmission or missing due to the congestion of an isolated branch.

The capacity of every electricity market depends on the available network or the transmission grid capacity which is available to the wholesalers, retailers and the final consumers located in any geographic area. National boundaries may or may not also be the boundaries of a certain supply field.

The electricity sector of a country represents the electricity generation industry. Taken in total, the electricity sector has the characteristics of a natural monopoly and the other represents a public good, of which not all the functional segments have these economic characteristics.

Electricity supply is specific, because the electricity is supplied through the final product and is a vertically interdependent quadratic process, consisting of the generation, transmission, distribution and supply of functional division, which is important for understanding the recent regulatory changes of the electricity sectors of all countries in the world.

Electricity production implies transforming other forms of energy (coal, nuclear energy, water, gas, wind, etc.) into electricity. The greatest amount of electricity is produced in nuclear power plants from coal power plants and a combined cycle from natural gas-oil. Smaller quantities of electricity are produced by power plants that use renewable energy sources.

The cost structure of electricity production depends on the technology used for the production, meaning factors such as capacity, thermal efficiency, life cycle, and the relationship defined and variable costs.

Fixed costs of nuclear power plants are considerably higher due to the long period which is required to build such plants, and costs related to public opposition to nuclear technologies. Variable costs are low due to the low cost of input energy and maintenance costs.

Hydroelectric power plants have lower fixed and variable costs, but the production capacities are substantially lower than in nuclear power plants, thermal power plants and combined cycle oil - natural gas plants and depends on the geography and climate of the area.

Thermal power plants and power plants with combined cycle oil - natural gas has lower fixed costs in relation to nuclear power plants, while their variable costs are high due to the high cost of input energy.

The existence of all manufacturers in one market power is necessary because of the individual characteristics of supply and demand.

The transmission and distribution of electricity provide transport from the producer to the consumer. This phase of the electricity production is considered to be a natural monopoly regardless of the degree of liberalization of the electricity market and is under the control of the Independent System Operator.

The supply of electricity sales to final customers. Sale includes measurement, billing and marketing, and can be wholesale or retail. Supply is not considered a natural monopoly, and there are significant benefits if it is integrated with other functions.

3 THEORETICAL ASPECTS OF THE LIBERALIZATION OF ELECTRICITY MARKET

The electricity sector has for a long time been a vertically integrated state-owned natural monopoly. In most countries in the world, the electricity sector was under control of one vertically integrated company and is strictly regulated by state agencies, which implemented their social policy over the energy sector.

Monopoly, as a model of organization of the electricity market has proven to be ineffective in terms of ensuring the real price of electricity. Because of this lack, as a result of technological advances in the production and transmission of the electricity there was a need for reforming the electricity sector, that is, liberalization of the electricity market.

The ultimate goal of the reform process is the introduction of competition in the electricity market, that is, providing opportunities for ultimate customer to choose a supplier/dealer from whom he will buy the electricity.

The reform process is very complex. Experiences related to previous steps taken to reform the process of energy sectors of the countries in the world have made it possible to establish a consensus on some generic measures for the achievement of functional and market oriented industry.

According to Pollitt and Jamasb (2005), liberalization generally requires the implementation of several interrelated steps. These steps are:

1. Restructuring of the sector,
2. Introduction of competition in the wholesale and retail market
3. Regulation of transmission and distribution networks
4. Establishment of an independent regulatory system
5. Privatization.

Table 1. The main steps of the electricity sector reform

Restructuring	- Vertical separation (unbundling) of production, transmission, distribution and supply
	-Horizontal separation of production from supply
Competition and markets	-Wholesale and retail competition - Allowing the entry of new producers and distributors
Regulation	-Establish an independent regulator
	-Allowing entry to the network to a third party
	-Incentives for regulating the transmission and distribution networks
Ownership	- Allowing access to the participants in private ownership
	-The privatization of existing state-owned companies

Source: T. Jamasb & M. Pollitt, *Electricity Market Reform in the European Union: Review of Progress toward Liberalization & Integration*, 2005, p. 29.

Electricity sector reform, aimed at the liberalization of the electricity market, based primarily on the restructuring of the electrical utilities and electricity sector as a whole, with the key role have answers to the following questions (Goić, 2003):

1. What kind of market variant to choose and in what form and dynamic to open it?
2. How to define the market rules of performance, and the rules of system and network governance?
3. What kind of proprietary footing will be, and how will the separation of electricity activities are going to be implemented? (Unbundling)
4. In what way the transitory problems will be solved such as inherited costs, public service requirement, that is the supply of tariff (unqualified) buyers, how to treat the privileged consumers, how to amortize eventual social consequences etc.?

The process of deregulation and changes in the understanding of electricity supply has led to the development of more sophisticated structural models of electricity markets with different degrees of competition.

These models represent a phase in the liberalization of the electricity market and the kind of the way that all countries must pass the reform process in the electricity sector. Each of these models implies the existence of some sort of market mechanism, which ensures the introduction of competition in the electricity market.

According to Vlahinić-Dizdarević (2011), four basic models for organizing the electricity supply sector are:

Model 1 - A vertically integrated monopoly, where there is no competition both in the production and in the sale of electricity. Consumers have no right of choice because they can buy electricity solely from a single, monopolistic company that is typically owned by the state.

Model 2 - A buyer or purchasing agency (monopsony) in which we are permitted or required by the existence of a buyer/wholesaler (purchasing agency) that can procure electricity from multiple manufacturers in order to encourage competition in the market. Given that in this model there is no free access to third parties and not ensure competition, the European Union had not accepted it as an alternative.

Model 3 - Wholesale on which it is enabled the distribution companies to select their suppliers, which introduces competition among producers and in the retail market. In this model, there is free access to the transmission system and the mechanism operates the wholesale electricity market. Improvement over the previous model was achieved by the possibility that producers can sell the electricity to various customers, any distribution companies, large industrial consumers, and not just for one customer, which makes the market competitive.

Model 4 - Retail sales in which all customers are allowed to choose their own supplier, which implies total competition. Also there is free access to the transmission and distribution network.

3.1 Market mechanism

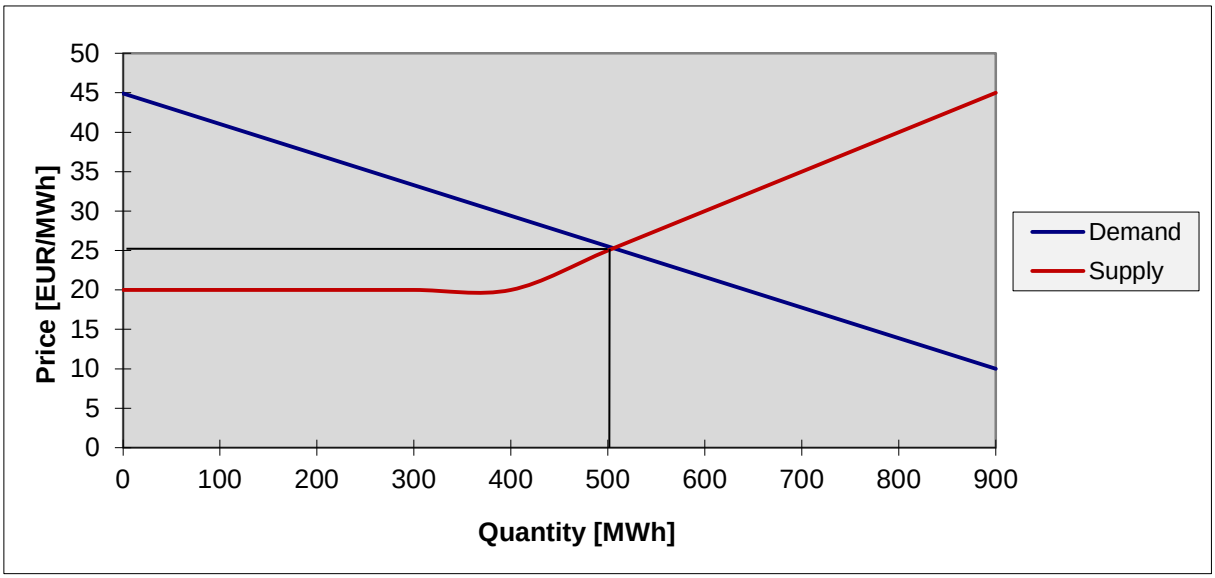
The easiest method to describe market interactions among customers and vendors is to assume the existence and attendance of an auction. Apparently, the task of the auctioneer is to ensure for the following things (Tominov, 2008):

- it is necessary to announce the range of prices for customers and vendors and to require that all market participants disclose how much money they prepared to purchase or sell at each price that is offered

- to determine and define a price that equalizes the quantity of customer demand with the quantity that the vendors are offering.

Certainly, in many cases most of the markets are able to operate without a precisely determined auctioneer. However, in many electricity systems that have separated activities, an independent market operator could operate as an auctioneer. The offered amount at each specified price is the schedule of offer or, simply, an offer. Figure 1 presents a graph of the offer and demand.

Figure 1. Electricity supply and demand



Source: I. Tominov, *Liberalizacija tržišta električne energije – ispunjava li očekivanja?* 2008, p. 260.

The price is presented on the vertical axis (y). The quantitative values are expressed on the horizontal axis (x). In order to demonstrate the electricity market, the vertical axis presents the price per megawatt hour [MWh] and the horizontal axis presents the quantitative values in MWh.

It can be noticed that in all markets is visible when the price decreases, then an increase in the quantity of the demand follows. It is obvious that customers want to buy more for a lower price and less for a higher price and that is the reason why the demand curve registers a fall. The evident fact is that in most markets when the values of price decreases, the offered quantity decreases, too. It can be concluded the offer curve is a positive. The curve of the offer can be at zero in the case when the suppliers can, due to their costs, offer more products for the same price (Tominov, 2008).

We can distinguish changes in the quantity of the demand due to changes in the price and shifts in the demand. It is possible that the demand for electricity can change from hour to hour in a day and from one season to another. Due to changes in the cost the supply curve can be modified as well. In the case the customers and vendors are content with a market results, market prices and quantities are in the balance.

3.2 Problems of the liberalization of the electricity market

We have to emphasize that electricity, as a driving force of the modern industry, represents a specific good. Electricity is consumed within a tenth of a second after production, and less than a tenth of a second could be stored electricity in a system. These physical characteristics of the electricity support the creation of the product whose final costs change rapidly and therefore delivery costs change rapidly as well. The thing that is important that delivery costs do not change as much for any other product (Tominov, 2008).

According to Tominov (2008, p. 290), in the deregulation of electricity we can cite several fundamental problems. These are:

- the complexity of the electricity system,
- local market power and
- shortcomings on the demand side of electricity:
    - the lack of metering and billing according to actual consumption and
    - the lack of the control of the actual energy consumption of individual customers.

The electricity system is a delicate and unique system that is widespread, as a rule, throughout the territory of an entire country. All producers who are incorporated into the system, the system must operate synchronously to a second. Voltage must be maintained within a 5 % limit in a many of separated and selected locations.

This process should be realized in a common plant. Half of the plant (the network) needs to operate for the general good of welfare and the other half (this refers to producers and suppliers) is motivated by various private interests. The problem of the complexity can be overcome with a well-conceived package of market regulations but the problem of local market power needs to be resolved – at least for now - through intervention measures.

Although the actual consumption began to be measured in the last decade of 1980s, it was interrupted for household customers. The fact is that none of the customers in the economy are able to see the price of the actual consumption. As a consequence of that, almost none of the customers respond to changes in the costs of energy that is delivered. It's supposed to be mean that first deficiency of the energy on the demand side causes a lack of the reactive demand to price, lack of elasticity of demand.

In addition to this deficiency, the market could operate in accordance with economic principles, but the problem is existence of the another deficiency on the demand side and that is an opportunity for customer to take energy from the network considering that he didn't previously made an agreement with the producer.

In addition to this shortcoming, the market should be able to function in compliance with economic principles but there is another shortcoming on the demand side – the option for

customers to take energy from the network without entering into a prior agreement with the producer.

If there was a possibility for implementation of bilateral contracts with the physical exclusion of customers who break the contract rules, the market could get a chance to function in accordance with a theory of competitive markets. The truth is that is not impossible on any other market psychically to provide an implementation bilateral contracts considering timeline of changes in price. Therefore, another deficiency on the demand side is an obstacle to psychical implementation of bilateral contracts and a cause that system operates in a specific timeline is a careless supplier as well.

Considering the fact that the reaction by demand to price is minimal, it is possible that it can lead to the appearance that the curves of supply and curves of demand do not intersect, and that is such a huge deficiency that other texts in the area of the economy do not analyze it. The system operator is forced to determine the price at least in the cases when offer does not meet the conditions of demand. Currently, all markets of the electricity operate in that way and that will continue until the weak of elasticity of demand gets strong.

These problems cannot be only theoretical ones - they represent the great disadvantages in the functioning of the electricity markets in practice, because they bring two extremely unacceptable relations between costs of production and prices of electricity in the markets.

Irreplaceable and colossal role of electricity, in life and in the economy as well, directs all countries to seek for fulfilling all their needs for electricity with condition of little dependence on imports as possible that represent a significant limiting factor of development for efficient competitive wholesale market.

Also, in the processes of creating a competitive environment in sector of electricity, in focus is more recognizable public significance of electricity supply services, especially in supply security, protection of the environment, in the protection of vulnerable users in area of regularity of provision, the quality of supply but also taking into account the price of delivering electricity (Tominov, 2008, p. 291).

All these requirements mean the reduction of the free market, especially in retail. This characteristic come to the force in the formation of the internal electricity market for the EU, where in the new Directive 2003/54/EC, comparing to the previous one, strengths the institute of the commitment of the public responsibility, for better protection of consumers, that is, for the better protection of general economic interests.

Despite the fact that all these problems and shortcomings are serious, they still do not show that liberalization is predicted to fail because certain markets are functioning really well. Probably, we can assume that by the time market demand would develop enough elasticity in terms of prices. That change in the market structure should be induced from the start.

First of all, liable deregulation of electricity should repair all disadvantages in demand, and then make repairs on the market. It is cheaper to repair these disadvantages in demand than the problems they have already caused.

The most difficult and the most expensive problems of the new electricity markets generally imply market structure. When we become aware finally cope with the disadvantages on the demand side and with problems of the market power and transmission, it is likely that we could find appropriate solutions for these problems.

3.3 The effects of the liberalization of the electricity markets

Based on the estimated cost and benefit ratio from the liberalization of the electricity markets, it can be assumed that liberalization will not probably achieve the main goal due to which it was initiated. The goal and reason for that is a decrease in electricity prices. This case occurred only once at the beginning of the process in some of the countries of the European Union and lasted as long as there were excesses of cheap electricity in Eastern European countries, therefore in the period from 1998 to 2002 (Ilie, Horobet & Popescu, 2007).

We have to emphasize that since 2003 the prices of electricity in Europe have recorded an upward trend. Now it has become clear and transparent that all those lower electricity prices are an illusion.

According to this finding, it is reasonable to ask why, despite various controversies and evident and unsuccessful liberalization of the electricity markets, that process continues with unmodified intensity. It seems that the answer to this question lies in the expectations of the major energy subjects on this market that, unequivocally, expect good profit. Also, they expect that they will take a good profit from many others due to the global benefits and profits of the liberalization of the electricity market. Moreover, there appear the opportunities for speculations on the market, where the large energy subjects have again an advantage. Bearing in mind that their home countries support them, and the fact that these countries are generally large, small countries are forced to follow this process and this pattern.

In the case of abatement to regulation, quality problem can be questionable, but the security of supply as well. In the most dramatic manner this case occurred in California, that is, in the United States, the most developed state of the first economic power in the world. If it is possible that something like this happens in the most developed state in the world, this should be a sign for particular caution in our further steps in the reform of electricity sector. Indicative could be other breakdowns of the electricity systems in the United States, England, Finland and Italy. This supposed to mean that too fast deregulation and uncontrolled liberalization, coupled with the lack of a long-term strategy of development return like boomerang with serious and long-term consequences. These

security risks of supply, considering that they are indicators of significant negative effect of liberalization, were also a great warning that a caution was necessary in the liberalization of the electricity industry. This has resulted in stagnation and retardation in the liberalization process. That is the reason why today an increasing attention is devoted to the security of supply and environmental protection, and only after the liberalization (Ilie, Horobet & Popescu, 2007).

Liberalization is being forced by those people who make a profit and benefit from it. We have to emphasize that the target price equalization was not achieved as well, because today still exist huge diversities in prices of electrical energy among countries, both for households and industry.

Considering the tendency of replacing state monopolies with private monopolies, which are deeply embedded, it can be noticed that there has been no significant shift in the organizational structure of the electricity industry from monopolistic to competitive structure.

It is noticeable that positive shifts have been achieved in raising the level of the quality of services and increasing the effectiveness and improvement of the sector by reducing the need for the construction and sustainability of reserved capacities. The most progress has been achieved in providing choice for consumers of electricity services due to the reason the majority of the markets are completely open (Rozić, 2009). This supposed to mean that for all consumers is provided choice for supplier of electricity services. This is more a formal right because a lot of markets have not been developed to a certain extent which can allow the consumers to exercise that right in the best way.

We have to summarize that these research results confirm that the primary goals of the liberalization of the electricity market are not yet accomplished, and it can be concluded that the liberalization of the electricity markets does not fulfill the expectations. Oppositely, according to the present state of reform and the trends in these processes, these goals are not achievable, mostly due to the manner in which they are imagined and outlined at the beginning of the reforms.

3.4 Estimation of the costs and benefits of the liberalization of electricity market

The electricity industry is undergoing an intensive process of reformation which is processed worldwide. Given that it is very common for reformers to inadequately assess the results of their implemented reformation, a big question rising on a global level is present: is the liberalization of the electricity market, moreover the deregulation, being practiced today bringing greater public costs or benefits?

Today's perspective shows that costs will be required when it comes to smaller customers or households. The regulated system will not ensure lower prices and therefore no benefits

will be acquired. Direct costs of the liberalization of electricity markets are not the sole costs arising from this process. They are closely followed by indirect costs, necessary for the financial support of workers (employees of the electricity company) due to their strenuous and stressful work accompanied by an uncertainty regarding their status (Tominov, 2008, p. 293).

On the other hand, the benefits which the electricity market brings are valuable and certainly indisputable. Here are the most significant of them (Tominov, 2008, p. 293):

- The increased regulation which is reflected in the transmission and distribution, when compared to a period prior to the change, shows an increased efficiency not only on the market, but also the monopoly operations of the company,
- a constant level of security is maintained even though the requirement for installing generating capacities are reduced,
- favorable hydrological conditions are utilized better and
- an improvement in the level of services is noticeable.

When presented with the above mentioned costs and benefits that arise from the implementation of the market in the electricity sector it is hard to say whether the benefits or the costs of such a process are greater. Otherwise, an opinion that the costs of going through with such a reformation of the electricity system and the electricity market would by far exceed the potential benefits it might bring is shared. It is hardly believable that even after the electricity market is in full operation that the benefits would exceed the incidental expenses of the electricity market. However, given that all of the market participants involved including the producer, supplier, trader, agent and broker would attempt to maximize their own earnings such a reform occurring will inevitably lead to the prices rising for the electricity customer. Such cases have already been known to happen in a number of markets, in a most inappropriate and unacceptable manner.

From the above described, it certainly appears that directing energy, time and assets to enhancing the security of supply, technical advancement and economic efficiency of the electricity system rather than to deregulation and liberalization, is globally far more efficient.

3.5 The European Union electricity market opening

During the 1990s in the last century, first electricity markets in Europe were founded in UK as well as in the Scandinavian countries.

Within the European Union itself were great distinctions concerning ownership and management of the electricity sector. Thus have France, Greece, Turkey, Italy and Portugal, for instance, nationalized their electricity production and transmission monopolies. The electricity industries of various countries run as regional businesses (Austria, Netherlands, Germany), and in Belgium, Denmark and Spain production is

primarily privately owned. Except regional businesses in Germany, there are also joint venture businesses (public and private) (Tominov, 2008, p. 16).

Such state led to the need for harmonization but also for taking to consideration certain peculiarities within the European Union. This resulted in the creation of European Union directives which stand for the minimum requests that the EU requires from member states, with the aim of removing monopoly from the electricity sector and opening the electricity markets. So, with the Directive 96/92/EC, more precisely with its successor Directive 2003/54/EC, common regulations are set up for the production, transmission, distribution and supply of electricity.

The electricity market liberalization fundamentals are based on the competition establishment in production and supply, and in free access to the transmission and distribution networks within the European Union, with the aim of making an internal electricity market. In order to form an efficient electricity market, it is necessary to put into service seven fundamental measures (Tominov, 2008, p. 18):

- the opening of the electricity markets in favor of the production which means enabling the manufacturing and generating capacities management on the bases of market,
- ensuring free access by third parties. Since the creation of parallel transmission and distribution networks is economically unfounded, it is essential to facilitate admittance for the third party to the existing networks under identical, unbiased conditions.
- the unbundling of the transmission and distribution activity from production and supply within the existing vertically linked businesses. Unbundling can be applied in four ways or by combining all four:

    - the unbundling of accounting for enterprises engaged in transmission or distribution corresponds to the weakest feature of unbundling,
    - the unbundling of administration in such a way that the network administration is separated from the administrating the rest of the enterprise,
    - legal unbundling in a way that a separate legal entity is established whose business actions will be limited to the networks,
    - the unbundling of ownership in a way that a vertically linked enterprise is required to sell the network,

- the formation of an independent regulatory body, because organizing the resourceful electricity market requires the well organized regulation of the transmission and distribution networks for three reasons:

    a) the prevention of extremely high prices,
    b) the prevention of subsidizing,
    c) the prevention of discrimination,

- insuring a high rank of communal services with the aim of protecting the common interests that are connected with the safe supplying, ecological protection and buyer's protection,
- admission reciprocity to markets of other countries, that is, equalization of tempo liberalization,
- making effective rules at the European Union-level.

The internal electricity market creation in the EU started with the Transit of Electricity Directive throughout transmission grids from 1990, whose main objective was making sure that the system operator in one of the member countries cannot obstruct the exchange of electricity among other member countries.

The internal electricity market nowadays in European Union is based upon the Directive 96/92/EC from December 19th, 1996. It went into effect on February 19th 1997, with due date for its implementation for the member states on February 19th 1999. From July 1st 2000 and onward, the Directive has been integrated in the EEA (European Economic Area Agreement), with which the internal market was widened to contain Norway, Iceland and Lichtenstein.

The overall aim of the Directive was to set up rules for the transmission, production, and distribution of electricity, which means that rules for the regulation and functioning of the electricity sector, market admission, the systems maintenance and supervision, and issuing consent for the creation of new capacities.

The Directive is based on three fundamental principles (Tominov, 2008, p. 18):

- the introduction of competition with the simultaneous respect for the principles of public service, according to which the proper and consistent electricity supply is secured, and that is of the highest significance for overall economic flow,
- introducing gradually the competition as to provide the needed period of modification,
- according to the code of subsidiarity, the Directive does not enforce complete solutions upon the member countries; it only offers a framework for the internal markets creation, leaving plenty space for the solutions acceptance that are most fitting in their situation.

Nevertheless, the electricity market's liberalization did not take place at the estimated tempo. Because of the large number of nominated amendments to the existing Directive, on June 26th 2003, the new Directive 2003/54/EC had been adopted. The Directive brought the most important modifications in the subsequent areas (Tominov, 2008, p. 19):

- the market opening dynamics,
- the method of issuing authorizations for the new capacities' construction,
- network admission,

- the requirement of system operators unbundling and
- the public service requirement.

The regulations of the Directive have been employed to the national laws of the member countries since July 1st 2004. with the aim of regulating trans border electricity trade, on June 26th 2003, the Regulation 1228/2003/EC was accepted on conditions for admission to the network for trans border electricity trade.

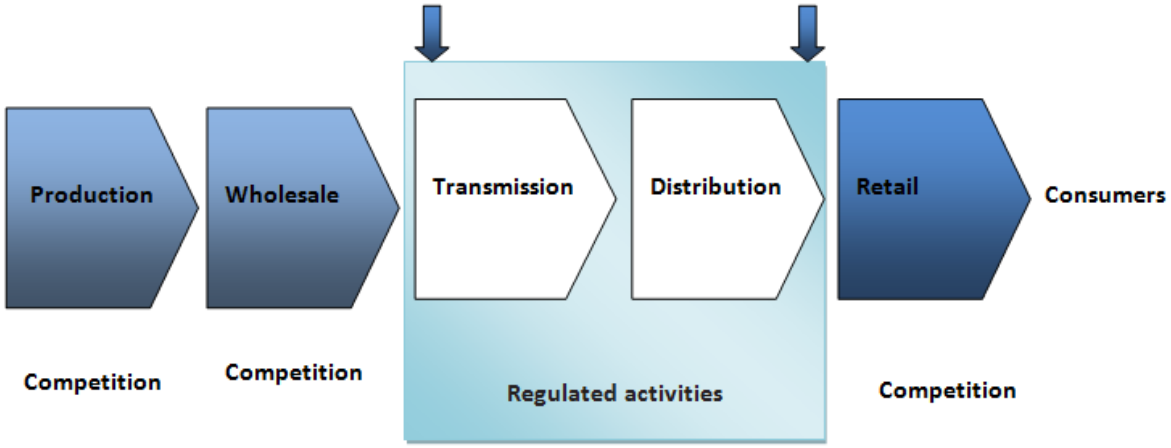
With this we openly support the formation of an inner electricity market, taking into consideration the peculiarities of the nationwide and regional markets. With this regulation, among other things, the mechanisms for the compensation of the trans border operator are being established (inter-TSO compensation), as well as the approaches for its remuneration and for utilizing the available interconnection facilities between nationwide transmission systems. The regulation has been in effect since July 1st 2004. The distinction between the Regulation and the Directive is that the Regulation is being straightforwardly and literally mandatory applied in the member countries and the Directive demands realization through the laws of the member countries.

4 REGULATION

The regulation includes a set of economic policies and mechanisms for its implementation which are institutionally controlled. The need for the introduction of economic regulation occurs in a situation where there is no possibility for the creation of competitive conditions in the market (a natural monopoly, public goods, the lack of market, etc.) and the abuse of market power by monopolies or a dominant player in the market is to be prevented. In other words, the introduction of economic regulation is necessary in order to allow control over the operations of companies in the markets where it is impossible to rely on a full and fair competition (Filipović & Tanić, 2008).

The reason for the introduction of competition in certain segments of the electricity industry was abandoning the previous stand of economic theory that electricity industry in the sector level should be viewed as a natural monopoly. This shift in economic theory has led to a situation in which the production and supply (retail and wholesale) introduced competitive business conditions, while the network activities (transmission, distribution and system operation) still remained regulated activities.

Figure 2. Unbundling activities



Source: S. Filipović & G. Tanić, *Izazovi na tržištu električne energije*. 2010, p. 25.

Regulation of network activities in the electricity industry, as a form of government intervention, must be established so that it ensures both the protection of consumers and investors' interests. In order to achieve the independence and transparency of the process, the regulatory bodies are established to govern, in an impartial manner, the relationships between all stakeholders and to apply consistently the methods of economic regulation (Omeragić, 2010).

Regulatory bodies are in the process of adopting an economic regulation faced with a double challenge - on the one hand, the need to protect consumers from excessive prices of monopoly services with satisfactory quality of service, while on the other hand, they have to protect the rights of investors giving them a reasonable refund of invested assets.

Effective economic regulation involves striking a balance between cost (the cost of the regulatory body, the restriction of freedom for regulated entities) and benefits of regulation (cost reduction, quality improvement, the introduction of competition). In addition, the emergence of new forms and mechanisms of regulation indicates that the objective of regulation and protection becomes broader social interests which include the control of external environmental effects. Therefore follows that, regardless of the introduction of market mechanisms, economic regulation is necessary for the resolution of imperfections in the electricity market.

Table 2. The main objectives of economic regulation

Encouraging efficiency	Determining the level of economically justified costs
	Establishing incentive measures and mechanisms to improve efficiency
Establishing financial viability	Determining the rate of return that will be incentive for attracting new investment
	Upgrading the system of receivables
Preventing discrimination	Between categories of consumers
	Encouraging competition by creating space for existing and new energy undertakings

Source: S. Filipović & G. Tanić, *Izazovi na tržištu električne energije*. 2010, p. 26.

Subject of economic regulation are the strategic parameters which imply the following (Filipović & Tanić, 2008, p. 126):

- Price control (defining the initial level of income, the dynamics of price adjustment, assessment of cost effectiveness);
- Quality of supply (continuity of supply, commercial and technical quality);
- Monitoring the market and the Electricity System (transparent market rules and agreements, system and network policies, labor market monitoring and corrective measures).

It has been already mentioned that the regulation of prices must simultaneously stimulate the investors, but also to take into account that the price of services are not too high. In other words, the cost of services must ensure that investing in regulated companies is profitable, allow continuous operation of the company, including investments, so as that consumers are not at loss.

Regulation of standards of quality of work and services is equally important as the regulation of prices, because the price and the quality are inextricably linked - a higher quality involves higher costs, and thus higher prices. To consumers the quality of service is as important as price, because if service standards drop and prices remain the same, consumers are at a loss as there has been a rise in prices. In competitive economies, an unhappy customer will either demand lower prices or will replace their supplier. Also, investors will less desire to invest, if they think that companies are investing too much or

too little in service standards. Monopolistic company, on the other hand, can try to collect revenue while decreasing the quality of the products and/or services which may result in additional costs to consumers. For this reason, the regulatory bodies must react in order to protect the interests of consumers. At some point an optimal compromise will appear between the costs and benefits of quality. This occurs when marginal gains of quality are equal to the marginal cost of delivered quality, which is the goal of the regulator.

Electricity as a product has its specific feature that is reflected in the fact that customer due to technical characteristics of the network cannot be offered a differentiated quality of supply in terms of reliability. For example, all customers in the same street will have the same level of reliability if they are connected to the same electricity supplier. Differentiation in price based on delivered quality could settle differences in the preferred choice of customers. This approach, however, would be very complicated and would have high transaction costs. Another approach would be to introduce the category of average customer thereby reducing maximize profit, but probably there would be no great individual variations. Also, a combination of these two approaches is possible.

Service quality in the supply of electricity has different dimensions that can be divided into three general groups: commercial quality, continuity of supply and technical quality. More broadly commercial quality includes the quality of the relationship between the supplier and the user. More precisely, we can distinguish between the general standards, which relate to the general provision of the service (e.g., the service provided or the minimum level of performance, the guaranteed standards, which may include a minimum time of response or paying the penalties in case of failure).

The continuity of supply (reliability) characterizes the number and duration of interruptions, which can be further differentiate by planned and unplanned interruptions or along any disruption in the provision of services. The float is a wide range of indicators of continuity of supply and they are mainly related to the frequency and duration of interruptions. The main difference is the weight that is used: it can for instance be a customer, consumption or energy. Technical quality describes the physical parameters of the electric energy which are related to the stability of voltage and frequency, voltage drop, overvoltage or distortion harmonics for electricity and pressure, etc.

In addition to price and quality, the subject to regulation can be the market. Market regulation involves activities related to:

- Defining the market and system of rules;
- Planning and security of the system;
- Production planning and
- Network planning.

The main function of economic regulation in a restructured electricity industry is to ensure fair and non-discriminatory market rules and system rules that provide equal conditions for all market participants. Market and system codified rules create links between different actors in the economy. Their universal applicability and necessity require regulatory

confirm and monitoring their implementation under the regulations. Therefore, the adoption of transparent market and technical rules of fundamental importance is for a functional and effective market. Trade rules are usually contained in a contract concluded between the parties. However, when there are specific rules that apply to several parties that perform certain activities, a more efficient and more transparent is that the process is regulated by a separate document. Market rules define aspects of commercial transactions and include general principles that accompany trade agreements and billing. System rules define the technical aspects of using network and system services (e.g. for the power they include rules of procedure of the transmission network, the rules of procedure of the distribution network, rules of measurement of energy consumed) and regulates the technical relationships between the network and the connected parties.

Regulation in the area of planning and security system aims to avoid investing in excess capacity and to maintain coordination in planning between the different elements of the system. The degree of analysis such regulatory monitoring depends mainly on the degree of market liberalization, or whether any form of competition is allowed and at what level of the system.

Regulation or planning the construction of new generating capacity in the economy which is vertically integrated and the model of a single customer has a strategic importance for the development of electrical system. The introduction of competition leads to a shortening of the contract duration and replacement of the contracting partners. The consequences of a wrong plan do not need to be borne only by the consumers but should be shared among the various parties participating in the market. Such a deregulated markets does not require a strict control of procedures for central planning and control of investments in competitive elements of the system (e.g., manufacturing). Planning is more informative than the mandatory character, and thus provides flexibility in the development of production projects (indicative planning). Indicative planning character does not force investors to carry out the determined investments. Although there is no requirement that companies invest, they will consider the possibility to expand the assessment system in the indicative plan. Indicative plan is as important as a good source of information for investors, while also being a good support to raise funds from third parties.

Network planning activities are necessary to prevent the monopoly to use the strategic network that disrupts efficient access to the region which is supplied. Information on the planning need to use all existing and future users of the network in the evaluation of the options that are available to them for new or additional use of the network in a competitive market.

Monitoring of strategic behavior and market power is a field of regulation which aims to ease the development of competition where that is possible in the electricity sector. This could be in terms of ensuring that license holders comply with existing legislation and, on the other hand, in terms of development and encouraging the government to expand the scope of the competition. Regulators responsible for competition with the highest ranking authority in monitoring the labor market and proposing changes in market rules or structure of the economy cope with the problems identified. Experience from Europe and

North America shows that mostly some specialized agencies (commissions) have been established which monitor the operation of the market and provide advisory services to the regulators in taking corrective measures on the market. These groups could be incorporated into the structure of the market operator and regulator, but can also be external entities that do not participate in their daily work. Different measures of regulators can be taken to lessen the negative effects of market position, such as the seizure of power horizontally, the upper price limit values, forward contracting, disclosure, etc.

4.1 Forms of regulation of electricity prices

Price regulation in network industries indicates the actions that operators restrict income, rate of return, operating and capital costs. The regulatory body responsible for economic regulation would be responsible to define the appropriate rate of return and to evaluate the level of economically justified costs.

Appropriate rate of return should prevent excessive, unjustified profit, and provide reliable operation and the possibility of replacing parts of the network, its expansion and improvement. Defining the appropriate level of return rates enables making of the strategic decisions about potential investments in this sector. New investments, if accepted as allowed cost are included in the regulated asset base through depreciation and the amount of allowable refund. It is possible that some companies get strong incentives to raise investment costs above those that would incur in case of investment by the criterion of minimum cost (a process known as *gold-plating*). Therefore it is necessary, to some extent, to regulate the level of investing justifiability of the company too. The level of economically justified costs means reasonable operating and capital costs, depreciation and return on assets which incurred by performing regulated activity (Blumsack, Lave & Apt, n.d.).

Electricity price is a complex category which should provide the relevant signals to investors, producers and consumers, so as the whole system of price formation of electric energy is a complex task. However, it often occurs in practice that due to giving support to developmental, social and other goals, the price of the electricity is formed so it does not fulfill the basic functions (informative, distributive, allocative and selective). The consequences of this policy are extremely expensive and usually lead to the irrational and excessive consumption of electrical energy and resources, environmental pollution, etc.

In practice, one can find three basic approaches that are used to determine the price of electricity (Filipović & Tanić, 2008):

- Setting the price based on historical costs,
- Setting the price based on marginal costs and
- Determining the market price of electricity.

Determining prices based on historical costs enables the producers to cover their costs with a "fair" rate of return, but not to get excessive profit. This method is particularly pronounced in countries where private ownership is dominant and where there is no

competition, and in terms of regulation varies from very detailed (e.g. the U.S.) to completely superficial (Germany).

Determining prices based on marginal costs enables covering costs, but greater emphasis is placed on the provision of correct economic signals that would lead the consumption and investment decisions. It is mostly present in highly integrated electricity industries that are owned by the state as is the case with France and Great Britain before privatization.

Market determination of the price of electricity is based on the assumption that the production of electricity and its delivery is fully liberalized and the price is formed through the stock exchange or through the purchase contracts based on the law of supply and demand.

Each of these models for the price forming has its advantages and disadvantages, and none of them is able to completely meet the required criteria of optimization which consider the minimum costs with maximum reliability.

Keeping the above in mind, the goal of price regulation is to control and eliminate the excessive exercise of the regulated entity's profits, encouraging at the same time the increase of efficiency and cost reduction. In the application there are several methods of economic regulation which can be divided into two basic groups:

- Rate of Return Regulation and
- Incentive Based Regulation.

According to Borenstein and Bushnell (2000), incentive regulation is further classified as:

1. Regulation of the maximum size (Cap Regulation) within which we differ:
   - Regulation of the maximum price (Price Cap Regulation)
   - Control maximum revenue (Revenue Cap Regulation)
2. Comparative regulation (Yardstick Regulation) and
3. Regulation indicators (Performance Based Regulation)

Regulation of the rate of return (Rate of Return Regulation, or a cost-of-service regulation and Cost Plus) is a traditional form of regulation whose essence is that the regulatory body determines the rate of return to cover costs and includes an adequate return on investment. The cost of services is generally determined by the period up to one year, after which the audit is performed and the elements for the coming year are determined. Price may include all necessary and reasonable costs which have a satisfactory level of quality of services provided, but the regulatory body is the one that evaluates which costs are justified. Because of this, the application of this method requires that the regulatory authority is involved in the details of business entity as it is the case with the U.S.A. (Von Danwitz, 2006).

The process of calculating annual income subject to the target rate of return, taking into account the planning and / or operating costs of previous years is presented by the formula (Filipović & Tanić, 2008):

$$DP = OT + A + T + (O_r \cdot R_o R) \qquad (1)$$

where:

DP - allowable revenue

OT - operating costs,

A - Depreciation (amortization)

T - income tax

O_r - regulatory asset base and it includes assets of regulated entity

R_{oR} - Rate of return

The main disadvantages of regulation methods of the rate of return are:

- Insufficient incentives to reduce costs;
- Lack of incentives for improving efficiency of operations;
- High costs of regulation.

The first problem of the regulation of the rate of return is that the regulated price is directly related to the individual costs of each regulated entity. If a regulated entity is incurring higher costs, this method allows him to increase the price according to the cost increase. If the investments are increased, basis for regulation is enhanced, which also affects the growth of prices of services. This behavior is completely opposite from the market model where prices are dependent on supply and demand and where unnecessary costs and investments always result in reducing profits. For this reason, profit and cost are inversely proportional. When costs increase, prices remain the same; the profit becomes smaller, suggesting a competition to reduce costs. If a regulatory body allows more cost, the entity will be able to charge higher prices to consumers of their services.

Another disadvantage of this method is a lack of competition over a longer period, which leads to a lack of business efficiency. Due to this, management of the regulated entity is not turned towards introduction of new innovative solutions in business process, and do not easily accepts innovation, especially if there is a lack of symmetry between the risks and rewards of such endeavor.

The third disadvantage is related to high administrative costs because the application of this method requires hiring more experts to control the cost of the services of the regulated entity. Such an approach may lead to a situation in which the cost of regulation outweighs the benefits that should result from the regulation. In conditions where there is market competition, a large part of the cost would be unnecessary, since it would protect consumers "invisible hand" of competition, not the "visible hand" of the regulatory body.

Because of these problems in the application of this method, the regulatory bodies have started to roll out new, more complex methods of stimulating entities enable profit growth achieved through lowering prices and increasing efficiency.

The regulation establishes a maximum price of a maximum price that the entity must apply in the period that usually lasts from three to five years. This type of regulation is first applied in 1983 in Great Britain in the telecommunications sector, and it later began to be used in the electricity sector in Argentina, Australia, Austria, Ireland, the Netherlands, Norway, Spain and Great Britain. Regulation of the maximum price, depending on the applied index called the CPI-X (consumer price index, CPI) or RPI-X regulation (retail price index, RPI).

Prices for each year are corrected for the applied indexes and efficiency factor X, which is established by a regulatory body. Regulated entity retains for itself all savings, a greater or smaller part of them, realized on the basis of reducing costs and increasing efficiency. Also, there is a possibility that excessive profits derived from the rate above some shared with consumers.

The maximum price is determined on the basis of the following formula:

$$P_t = P_{t-1}(1 + CPI - X) \pm Z \qquad (2)$$

where:

P_t - the price in year *t*, which is calculated based on the sales price of the previous year

P_{t-1} adjusted for the consumer price index *CPI* minus *X*. Factor sales price of P_t can be corrected by the correction of factor *Z* which is the result of external events that affect the business subject.

Regulating body in the first step determines the reasonable price level, and then sets the condition that the actual price of each year, until the next revision of the price, it must reduce the coefficient of *X* Factor *X* reflects the expected annual target to reduce overall costs and usually similar to the annual long-term gains from improved productivity. In the beginning, it can be defined as 0 if the state or a regulatory body does not want to enforce the regulation that goes in the direction of improving productivity.

CPI-X mechanism offers an opportunity to improve efficiency, which in the long run leads to a drop of prices. Given that the application of this method sets the upper limit on the cost of services, the regulated entity's interest to increase the amount of electricity supplied to earn more income and profits. However, in some countries (especially in the U.S.) there are certain obstacles to such attitudes, which are also reflected on application of this method because it is contrary to the social welfare and efficiency programs.

Another problem that arises in the application of this method lies in the practice according to which the regulatory body does not need to approve the costs in the next period if

regulated entities, because of reduced spending, earn less income than planned; fluency of application of the price cap method depends largely on the length of the regulatory period. Although it is common that period lasts between three and five years, if that period is one year, then between the regulation of maximum prices and rate of return regulation there are no significant differences. As longer the period of regulation is, the subject has more interests to reduce costs, given that the profit will not be revised by the end of the period.

However, even when used for a long period of time, as the time of the audit is approaching, the subject is no longer have interest in reducing the costs, but it is showing interest in presenting business through achieved high costs, given that the initial price would be adjusted to them in the new period. Incentives to reduce costs are higher if the price at the beginning of a new period remains unchanged. In this case, all future savings belong to the entity, and this it will endeavor to increase profitability by reducing costs. In order to avoid this situation, except to establish the optimal duration of the period of regulation, it is parallel with this method to introduce and monitor the quality of electricity supply, or to determine a reasonable level of individual quality parameters that must not be reduced for the purpose of achieving higher profits.

In revenue cap regulation, similar to the regulation of maximum prices, the objective of the regulatory body is to give an opportunity to a subject to maximize profits by reducing operating costs and that these savings, which it achieved during the period of regulation, keep for itself. .With this method, the costs allocation per category of consumers, that is, structuring of tariffs, is established by an entity.

Allowed revenue is determined by the following formula (Filipović & Tanić, 2008):

$$R_t = R_0(1 + CPI_t - X) \pm K_t \qquad (3)$$

where:

R_t - allowed revenue in year t

R_0 - allowed revenue at the beginning of the period of regulation

CPI_t - producer price index increase over the base year t year price control

X - factor that determines the efficiency of the regulatory body

K_t - correction factor for insufficient/excessive overdraft allowable income in year *t-1* price control

It is calculated as the variation derived from the allowable income in year *t-1* compliant with agreed rate of interest (for example, the company estimated the cost of debt) divided

by the predicted amount of sale for the year *t*. The purpose of the *CPI* is to set the entity realistic targets in terms of profit by increasing revenue productivity during the audit.

The application of readily available index such as the consumer price greatly simplifies the process of forecasting permitted revenues as to the subjects so as to the regulator. The advantage of this method is that it can be applied in conjunction with measures of receivables management. However, this method because of limiting the income affects the incentives to restrict the efficiency of operations. With the revenue cap, and in the regulation of maximum price, price regulation is not associated with the regulation of quality of electricity supply. The introduction of price regulation can affect the quality of service, and it is also one of the biggest drawbacks of this model.

Comparative regulation is not based on the estimation of level of the costs of an individual subject, but on the comparison of the prices or costs of the group of regulated entities. In this way, price or income allowed depends on the average indicator groups of subjects. Deficiency, and thus the risk, application of this method is the possibility that the environment in which regulated subjects operate differs. For example, differences in the cost of two subjects can be the result of external factors such as climate, population density, etc. Compared with other methods, this approach is useful in cases where cost data are not available or are not reliable enough.

As the observed indicators of business entity compared with outcomes in other regulated entity in the group, by this method it is possible to encourage one another in direct competition. However, in the application of comparative regulation there are several problems relating to:

- The degree of comparability between entities;
- Harmonization of data;
- The causes that led to the current situation.

Because of that, this method can be used as the basis for the collection of relevant information because of the introduction of price cap as it reduces informational asymmetries between the entity and the regulatory bodies.

The control indicators in contrast to all previous methods which are not taken into account the quality of regulated service, which means that the regulatory body defines a set of qualitative and quantitative indicators (e.g. technical losses). If the entity does not achieve specified parameters, the punitive measures are provided, and vice versa, if the subject achieved above the minimum set of parameter values, the regulator rewards him. The introduction of these methods into practice requires a very detailed preparations and cooperation between operators and regulatory bodies. The method of regulation indicators is commonly applied by introducing the quality control through introducing regulation of quality supply parallel to the price regulation (Filipović & Tanić, 2008).

4.2 The goals and objectives of regulation

Although the goals of regulators differ from country to country and from one sector to another, the protection of consumer interests, both short-term and long-term, is the primary goal for all and it is established by increasing economic efficiency.

Determining the tariff structure which allows the regulated subject to acquire the earnings required for covering operational costs and an equitable return is considered to be the primary short-term goal of the regulator of electricity. On the other hand, coverage of the total demand which is achieved by stimulating the regulated subject in order to create sufficient transmission and distribution capacities is the primary long-term goal of the regulator of electricity. Appropriate incentive for building new generating capacities should follow an investment that brings reasonable earnings to a regulated subject. If a regulated subject is obtaining a rate of return on investment that is higher than normal, it has an incentive to build more capacities than necessary. Determining whether these new capacities are a reasonable step is carried out by issuing a permit for the construction of new capacities on behalf of the regulator in order to address this problem.

Integrated resource planning (*IRP*) sometimes requires the regulator to determine whether the minimum necessary revenues will be brought in by a suggested technology or system. The least expensive expansion plans, such as a balanced mixture of production units, transmission, distribution installations and integrated demand side actions are determined by integrated resource planning. This requirement increases regulation costs, so that the cost-benefit ratio must be calculated before the regulator becomes involved in this activity. Control and balance within the regulatory system can also be increased by entrusting this procedure to another regulator (Hall, 1998).

Stimulating investment to the extent that proves to be sufficient for meeting the demands of consumers as well as the return of a reasonable amount on investments to investors is the task of regulation. Since the electricity sector is being reconstructed, the task of the regulator is to determine market rules which will lead to conditions that are most similar to competitive ones, meaning that prices and quantities resemble those in the real competitive circumstances.

Economic regulation of network activities refers the means by which limitations are established for network system operators regarding pricing, revenues, rate of return, and operating and capital costs (Kahn, 1971).

Finding a balance between the optimal use of existing generating capacity and the optimal increase of capacity is a problem encountered by regulation. One of the prerequisites for eliminating obstacles on the way to the introduction of competition to the electricity market, particularly insofar as this concern and electricity companies that also performs regulation (these being the management of the electricity system as well as the transmission and distribution of electricity) and market activities (the production and

supply of electricity). Inefficiency and distortion in the development of transmission and distribution systems are caused by tariffs for using a network system that does not reflect the economic costs (Tominov, 2008, p. 286).

The implementation of unbundling within enterprises that perform both regulatory and market activities is an essential prerequisite for introducing a transparent methodology used for calculating tariffs.

In order to assign each activity solely the cost which it incurs, each individual activity should be treated separately in terms of accounting within an integrated electricity enterprise, as it is stated in Directive 2003/54 EC. A regulatory body cannot prevent cross subsidies among various parts of an integrated electricity enterprise without the essential element of regulation – unbundling activities in accounting.

A set of access rules control entering and exiting a sector, which is an important task of regulation. With competition, an actual or possible entrance of a competing bidder reduces the market power of the companies in the sector (Tominov, 2008, p. 287). A contract, which defines the relationship between the two party states that the regulated subject shall be provided the exclusive right to perform certain activities and is, in exchange, submissive to regulatory control. This contract is included in the process of electricity regulation. Many industrial processes may produce electricity as a byproduct (coproduction) and not distributing eventual surplus energy from these industries would be socially inefficient. The decision of who can sell electricity and at what price to the exclusive distributor belongs to the regulator. On the other hand, companies leaving competitive markets do not present a similar problem. If a company is bankrupt, the regulator must find a new owner for the property and concession.

4.3 Regulatory Commission for Electricity in Federation B&H - FERK

The Electricity Law (*Official Gazette No.41/02*) that created the Regulatory Commission for Electricity in Federation – FERK, charged it with defining the methodology and criteria for setting prices for the supply of non-eligible customers and determining tariffs for users of the distribution system and tariffs for non-eligible customers, as well as determining prices on each power plant bus bars until electricity market is established based on transparent process.

As part of this rulemaking process, FERK encourages and welcomes the submission of public comments on the proposed tariff methodology.

Prior to the passage of the Transmission Law (*Official Gazette of Bosnia and Herzegovina, 7/02 and 13/03*), the Federation Electricity Law (*Official Gazette FBiH, No. 41/02*), and the Republika Srpska Law on Electricity (*Official Gazette RS, No. 66/02, 29/03, and 86/03*)**,** the State and Entity Ministries within Bosnia and Herzegovina were responsible for regulating the activities of all companies in the electricity sector. With the signing of the Electricity Policy Statement and the passage of the Transmission Law and the Entity Electricity Laws, the reform of the electricity sector in Bosnia and Herzegovina began.

The creation of an independent regulatory body, which is a central tenet of the electricity sector reform process worldwide as well as in Bosnia and Herzegovina, results from an acknowledgement that the policies for the provision of safe, reliable, non-discriminatory and reasonably priced service must be set independently of the business operations of the energy utility. This separation of power is particularly appropriate in the case of state-owned electricity enterprises, as judgments of the State, as owner, cannot be completed in a transparent and unbiased fashion due to the nature of the relationship between the energy utility and the State.

The three electricity laws together provide for the regulation of the electricity sector by three regulatory commissions. The State Electricity Regulatory Commission (DERK) regulates the new Transmission Company and Independent System Operator (ISO) being formed pursuant to the Law Establishing the Company for the Transmission of Electricity in Bosnia and Herzegovina (*Official Gazette of Bosnia and Herzegovina* 35/04) and Law Establishing the Independent System Operator of the Transmission System of Bosnia and Herzegovina (*Official Gazette of Bosnia and Herzegovina* 35/04), and is responsible for setting tariffs for those companies. REERS and the Federation Electricity Regulatory Commission (FERK) regulates the generation, distribution and supply of electricity in Republika Srpska and the Federation of Bosnia and Herzegovina, respectively, and will be responsible for setting tariffs for companies supplying those services. While all three regulators are bound to follow the broad policy directions and objectives of their governments as articulated through the laws, they are also specifically made independent by their authorizing laws so that they can implement the policy in a competent and professional manner, in a transparent process and with the participation of the public. This results in decisions based on fair and objective process.

Establishment of DERK, FERK and REERS, are only one part of the reform process of the energy sector in Bosnia and Herzegovina, and this process is in accordance with an identical process which is implemented in the European Union member countries and all transitional countries which have the intention to become a part of the European Union.

5 INDICATORS OF THE BOSNIA AND HERZEGOVINA'S ELECTRICITY SECTOR

Electricity sector, as one of the most important sectors in the industry, usually is not uniquely organized throughout many countries. Mostly, the electricity sector is created by the unique situation that the country is in, which is a transitional phase to market economy and multipart possessing's formation and other relevant factors. Some peculiarities of the electricity sector mainly are products of the demand, requirements and prospects of the state's economy generally speaking, nevertheless, indications such as arrangement, proprietorships, variety and quantity of natural assets of the state mark the distinctions of the sector. According to the survey, the electricity and economy market's goals are clear, but the way of achieving them are different in every state.

First of all, it is necessary to explain the composition of the electricity sector. The electricity sector is made of three identical parts: sources of electricity (production), transmission and supply networks and customers.

Electricity, as a generator, is in the center of all this structure. It is a commodity and good as well which cannot be stored and by that it's different from all other commodities. With the aim of using benefits of electric energy, there must exist a well indented network. If it is the highest voltage system, we have in mind the system of a transmission. If the system voltage is low, or medium we say it is the distributive system. But, there is a difference between consumers: larger users get electricity from generators right through the transmission network, which is frequently structured at the state or global level.

Smaller electricity users, as an ordinary person, can obtain electricity only through the distribution system. Electricity sector has a goal to offer safe electricity distribution to users and all that for minimum fixed cost and expenditure.

In Bosnia and Herzegovina electricity has been produced and used for a very long time, based on literature sources, for almost 119 years. The initial power station was constructed side by side to the colliery in Zenica in 1888, only seven years before that the initial power station in the world started operating – in 1881, New York. But other reasons didn't go in favor of B&H. At that time, the economic situation in B&H was poor and the process of introduction of electrification in B&H was slower than in the developed European countries. According to the survey, till the end of 1919, only 1.1% of populated places got electricity.

After the Second World War, more precisely in 1945, 16% of towns and villages in B&H already had electricity. Comparing those results with the results recorded in 1980 that percentage increased to 93%. When we talk about production of electricity, production of electricity in 1945 reached 65 million kWh. In 1992, that production reached 13.7 billion kWh which was by far stronger and more widespread than in 1945 (Mulijagić, 2007, p. 10).

"In 2002, an additional 10.8 billion kWh was produced. Comparing the results of the total quantity of electricity, the total quantity of electricity used in 1945 was 55 million kWh, 10.6 kWh billion in 1991 and 9.7 billion kWh in 2002." (Rozić, 2009, p. 3).

Bearing in mind the excellent location of B&H in the heart of Europe, just between Western and Eastern Europe and its enormous electricity potential, Bosnia and Herzegovina fits in a set of the chosen minority of countries in the South-East European region that generate enough electricity for its own usage, and that has additional supplies, which is truly remarkable. Together with Romania and Bulgaria, Bosnia and Herzegovina is the sole electricity exporter in the South-East Europe. That's the reason why the electricity sector has an immense part in prosperity and economical development of the country.

“It makes more than 12 % of B&H GDP and with more than 700 million of EUR of annual income. Its net assets worth is estimated at 5 billion of EUR and according to some figures; more than 50 000 people in Bosnia and Herzegovina have benefited from this sector and are living directly from it”. (Rozić, 2009, p. 3).

According to Rozić (2009), Bosnia and Herzegovina has a significant number of electric power plants: B&H’s electricity sector is disposed on 14 hydro and 4 thermal electric power plants. Most of hydroelectric plants are situated in the area of Herzegovina (on the Neretva River). The biggest thermal electric plant - located in Tuzla, in the area of North – East Bosnia – disposes with available power of 635 MWh. Although Bosnia and Herzegovina maximally uses its water potential, especially from the Neretva River, most of electricity in the country is gained from thermal electric plants. The reasons for that are the following: available power of thermal electric plants is much bigger than energy gets from hydroelectric plants, and that is why they represent an excellent skeleton for sustainable energy sector (Rozić, 2009, p. 3).

The reasons for that are the following: available power of thermal electric plants is much bigger than energy gets from hydroelectric plants, and that is why they represent an excellent skeleton for sustainable electricity sector (Rozić, 2009, p. 3).

Based on the electricity pointers and anticipated economic outcome, in 2008 electricity sector reached the biggest success since 1991. That was the first time after a long period of failures in this segment that it achieved earnings and success as it should.

The results of this success are shown below:

- During 2008 more than 14 000 GWh of electricity had been generated, and that was the finest sign of a rise of 4, 4% matched up to the previous years.
- During 2008 electricity utilization also achieved its upper limit of 12 241 GWh.

Due to the increase in production volume, the electricity international trade in 2008 with bordering countries also increased. Bosnia and Herzegovina exported almost 4 200 MWh of electricity, generally to Montenegro and Croatia. As opposed to these countries, Bosnia and Herzegovina fits in the group alongside Romania and Bulgaria, those are the sole system electricity exporters in the South East European area that can close their yearly electricity balance without larger importations (Rozić, 2009, p. 3).

Today world suffers from the constant energy a crisis that has gripped all around the world. B&H is right now in a remarkable position when compared to other countries in the region, and should continue to improve itself constantly.

Liberalization and restructuring of electricity market in B&H legitimately started in 2000. If we observe the legislative acts, without observing the actual situation in practice we could say that the liberalization officially started in 2000, but that is not a case. Liberalization was conducted only *de jure*. According to latest data all customers, except

households, as of the January 1st 2008 have the ability to freely choose their supplier of electricity. Customers in the category households will gain the right at January 1st 2015 and since that date the electricity market in Bosnia and Herzegovina will be fully open.

The period prior to the opening of the electricity market has been declared transient, and FERC has prescribed dynamics by which customers will become eligible:

- 01.06.2012. buyers at 110 kV and above
- 01.01.2013. buyers at 35 kV
- 01.01.2014. buyers at 10 kV
- 01.01.2015. all electricity customers.

If the buyer of electricity become qualified, but did not choose their supplier of electricity, during the transitional period is allowed to continue to supply the customer by their previous supplier, which in this case becomes a public supplier. The price of electricity supplied by public supplier customers also ordered by FERC.

5.1 The structure of the B&H's energy sector

The General Framework Peace Agreement (Dayton Peace Agreement) signed on the December 14, 1995 which represented the end of the War of the early 1990's saw a new division of the electricity sector which was in accordance with division of the State. The electricity sector followed the rather atypical division of the State which comprised of two separate entities – the Federation of B&H and Republika Srpska, along with 10 cantons, not including Brčko District which enjoys a special status - and was itself divided into 3 separate electricity companies all granted licenses to generate, distribute and supply electricity in relation to the above mentioned structure of the State. The government still had jurisdiction over the level of the rates and oversaw the investment but the three states owned companies located in the established franchise areas and operated them as monopolies.

All three of the above mentioned companies still have a monopoly on these territories which are still divided by mostly ethnic criteria into the integrated structures and have solely entity ownership, not state. For example, of the three companies, the two which are situated on the territory of the Federation of B&H are also owned by it in a 90% ratio, while the third company is owned by Republika Srpska. From a practical point of view, this actually means that every constituted nation of B&H (Croats, Serbs and Bosniacs) each has their own electric company. Furthermore, competition is not an issue among the three of the companies even though they are synchronized and connected in every technical way.

Elektroprivreda B&H (EPB&H), a public enterprise is, judging by its capital value, installed capacities, total generation, sale of electricity as well as the number of customers

located on its field of supply, the leading electricity company. According to its structure of the ownership, it is a joint stock company - the majority shareholder is the Federation of B&H with a share of 90% while the rest of the shares in the amount of 10% belong to Privatization Investment Funds and small shareholders. The total capital of EPB&H is 1.5 billion EUR (Mulijagić, 2007).

EPB&H has two thermal electric plants which are located in Kakanj and Tuzla, 9 hydroelectric plants comprising of bigger plants located on the Neretva River at three separate locations: Jablanica, Salakovac and Grabovica, and six other smaller plants all with installed capacities of 1,682 MWh. It distributes energy across the seven cantons located within the Federation of B&H, supplying 675.000 customers of which 90% are households. According to Rozić (2009, p. 5), "EPB&H operates with a distribution network of voltage 35, 20, 10 and 0.4 KV in total length of 31 757 km, with 6 880 transformer stations with total installed capacity of 2 820 MVA."

According to Rozić (2009, p. 5), "in 2007, the generation of electricity amounted to 6,544 GWh, while consumption was 4,358 GWh. More than 88% consumption is spent on distribution network (from small businesses and households). From its electricity sales, in 2007 EPB&H realized a total revenue of 765,3 million KM (382 million EUR) and gained profit of 11,5 million KM (6 million EUR)".

Another electric company in the Federation of B&H, established in 1992 following the dismemberment of the energy sector which was dominant in B&H prior to the war, is the Public Enterprise Elektroprivreda Hrvatske zajednice Herceg Bosne (which will hereinafter be referred to as EPHZHB). By the year 2004 it had been divided into two shares that is turned into a joint stock company of which the majority, 90% belongs to the Federation of B&H and the rest of 10% belongs to small shareholders.

The six hydroelectric plants which belong to EPHZHB have installed capacities of 792 MW and are situated in the following locations: Rama, Čapljina, Mostar, Jajce I and II and Peć Mlini. According to Rozić (2009, p. 5), "EPHZHB operates with 10 883 km of distribution network with voltages from 35, 10, 20 and 0,4 KV, serving at the same time over 182 thousand customers located in 35 municipalities of 5 cantons." Another important customer of EPHZHB is Aluminij from Mostar, a company which represents a major electricity consumer in B&H – more than 20 % of the electricity produced is directed to that company.

In 2007, EPHZHB generated a total energy of 1 128,10GWh. However, given that in 2007 the rate of EPHZHBs' electricity consumption was quite high - reaching up to a capacity of 3 363, 83 GWh, this generated quantity could merely cover 1/3 of the requirement. Aluminij uses more than 60% of the electricity generated by EPHZHB. This leaves the EPHZHB with the inability to produce the amount of electricity which meets its own needs as an electrical distributor, and therefore forces this company to buy electricity from the international market which sells it at prices significantly higher. All of these circumstances

further on lead to higher electricity bills for the household consumers located in the distribution area of EPHZHB, in comparison to other electricity consumers in B&H.

The only electricity company possessing a license to generate, distribute and supply electric energy in the territory of the Republika Srpska is Elektroprivreda Republike Srpske (hereinafter referred to as EPRS) which gives it multiple monopolies. It was also, like EPHZHB, formed after the dismemberment of the energy sector of B&H prior to the war.

The two thermal electric plants which belong to EPRS are located in Ugljevik and Gacko, while the five hydroelectric plants are in Bočac, Trebinje and Višegrad, and two smaller ones has the installed capacity of 1424 MW. More than 436 000 customers are served by this company with more than 400 000 households entity wide.

According to Rozić (2009, p. 5), "EPRS disposes with 2 thermal electric plants (Ugljevik and Gacko) and 5 hydroelectric plants (Bočac, Trebinje, Višegrad and two smaller once) with installed capacity of 1 424 MW. It serves more than 436 000 customers, with more then 400 000 households." Another smaller distribution network located in Brčko District is also going to be mentioned along with the three major companies. However, this company doesn't have the generating capacity required, which forces it to purchase electricity from the three above mentioned companies present within the country. It mainly distributes electrical energy to households (90% of the total of 26 000) while the electricity consumption rises up to 257, 2 GWh per year.

5.2 The possibilities for the development of the energy sector of B&H's

According to Jenko (2007, p. 11) "there have not been any significant investments in new power system facilities in B&H since the war. Nonetheless, there is large private sector interest in harnessing the substantial and relatively diversified energy resource base in B&H to expand power generation capacity to meet growing electricity supply deficit within the region of the Energy Community."

"The status of new generation projects (both coal-fired thermal power and hydropower plants) under consideration for implementation within BH, is summarized below. It is an urgent issue to develop and adopt a state-wide, uniform and transparent procedure for construction of new generation plants on the basis of recommendation from EU Directive 2003/54." (Jenko, 2007, p. 11).

5.2.1 Existing power plants and end of operations

A concise overview of the existing power plants in Bosnia and Herzegovina is given in the following chapter.

5.2.1.1 Federation of Bosnia and Herzegovina

The following table shows basic data describing the already existing power plants located on the territory of the Federation of B&H (FB&H). The Federation disposes with a total amount of hydroelectric power which amounts up to 1 256 MW, while the annual production is 3149 GWh. Three large hydropower plants are part of the EP, along with several smaller hydropower plants which have a total power capacity of 509 MW and produce 1580 GWh per year. On the other hand, EPHZHB consists of six hydroelectric plants which all have a total power of 747 MW and produce a total amount of 1 569 GWh per year (Željko, 2009).

Table 3. Existing hydroelectric power plants on the territory of the Federation of B&H

Federation of B&H - Existing hydroelectric power plants			
Elektroprivreda B&H			
Name	**Net capacity**	**Expected yearly production**	**Useful reservoir content,**
	MW	**GWh**	**GWh**
Jablanica	175	771	70
Grabovica	114	334	0.4
Salakovac	207	410	1.7
Small HE EP B&H	13	65	0
Total EP B&H	**509**	**1580**	**72.1**
Elektroprivreda HZHB			
Čapljina	400	200	3.4
Rama	159.4	650	303.0
Mostar	71.6	247	0.4
Jajce I	58	233	0.5
Jajce II	28	157	0.2
Peć Mlini	30	82	0.2
Total EP HZBH	747	1569	307.7
Total FB&H	1256	3149	379.8

Source: Energetski institut Hrvoje požar, Ekonomski institut Banja Luka & Rudarski institut Tuzla, *Studija energetskog sektora BiH, Konačni izvještaj*, 2008, p. 18, Table 3.1

The basic information on the power plants located in the Federation of Bosnia and Herzegovina is presented in Table 4. The table shows that while all the thermal power plants belong to EPB&H, EPHZHB only disposes with hydroelectric power plants. Thermal power plants have a total of 1 015 MW of net capacity available. Coal is the fuel of choice in all the power plants, and it is of domestic origin (brown coal and/or lignite). The fuel prices which have been mentioned are in accordance with the realized procurement fuel prices in 2006. What should also be noted is that the Government of the Federation of Bosnia and Herzegovina regulates the prices of coal for thermal power plants on its territory.

Table 4. Existing thermal power plants on the territory of the Federation of B&H

Federation of B&H - Existing thermal power plants						
Elektroprivreda B&H						
Unit name	**Net capacity [MW]**	**Coal**	**Heat value of fuel [kJ/kg]**	**Fuel price [EUR/GJ]**	**Heat rate [kJ/kWh]**	**Retirement [Year]**
Tuzla G3	85	lignite/brown coal	10407	2.27	14404	2013
Tuzla G4	175	lignite/brown coal	9948	2.27	12150	2018
Tuzla G5	180	lignite/brown coal	10430	2.27	12200	after 2020
Tuzla G6	190	brown coal	16062	2.27	11810	after 2020
Kakanj G5	95	brown coal	13732	2.01	11700	2018
Kakanj G6	85	brown coal	11700	2.01	14433	after 2020
Kakanj G7	205	brown coal	11400	1.98	12260	after 2020
Total FB&H/EPB&H	**1015**	-	-	-	-	-

Source: Energetski institut Hrvoje požar, Ekonomski institut Banja Luka & Rudarski institut Tuzla, *Studija energetskog sektora BiH, Konačni izvještaj*, 2008, p. 20, Table 3.2

Facilities including Tuzla G3, Tuzla G4 and Kakanj G5 are all expected to end their operations no later than 2020. In the order in which they are listed above, the years in which the end of operations is expected are 2013, 2018 and 2018. In the year 2005, Kakanj G7 had been revitalized. Tuzla G5 was also subject to revitalization in 2008, while Tuzla G6 and Kakanj G6 are also planned to be revitalized. When revitalization is completed, the above mentioned units are expected to end their operations once the monitored planning period is over, which means no later than 2020. However, there is an expected extended period of 15 years for the revitalized units. It should also be noted that Tuzla G3 and Tuzla G4 also supply industries and households within the area of Tuzla with thermal energy when considering the end of operations and revitalization.

Bearing this in mind, it is necessary to have a backup production facility situated in these locations. Another condition like that can also be seen at the Kakanj location, where existing blocks also supply customers with thermal energy. This situation should be considered even more so because there are plans for the thermal supply of Sarajevo to be redirected to the Kakanj thermal power plant (Kakanj TPP).

5.2.1.2 Republika Srpska

Elektroprivreda RS and HEP share the power produced by HE Dubrovnik (which is located in the Croatian electric power system) in a 50:50 ratio, which should be taken into consideration. This is achieved thanks to one generator being connected to the EPRS system and the other to the HEP system. In accordance with that, Table 5 shows data on power and the expected yearly production of HPP Dubrovnik which apply to the chair used

by ERS, i.e. half of the total power (one of two generators in total) and half of total production (single generator production) (Željko, 2009, p. 337).

Table 5. Existing hydroelectric power plants on the territory of Republika Srpska

Republika Srpska - Existing hydroelectric power plants			
Name	**Net capacity**	**Expected yearly production**	**Useful reservoir content**
	MW	**GWh**	**GWh**
Višegrad	315	1038	11.0
Bočac	110	307.5	5.5
Trebinje I	180	535.4	-
Trebinje II	7.6	12.5	0.4
Dubrovnik I (50%)[2]	108	695.6	-
Small and industrial power plants	15.2	72.0	0
Total	**735.8**	**2660.9**	**274.7**

Source: Energetski institut Hrvoje požar, Ekonomski institut Banja Luka & Rudarski institut Tuzla, *Studija energetskog sektora BiH, Konačni izvještaj*, 2008, p. 21, Table 3.3

The hydroelectric power plants situated within the RS produce a total available capacity of 735 MW adding up to an annual expected production of 2661 GWh. The utilization of the Trebinje reservoir provides 9,36 GWh. The contribution of the Bileća reservoir to the total production of HPP Trebinje and HPP Dubrovnik is 1010 GWh, while its contribution to HPP Trebinje is alone 200 GWh.

ERS has gathered the data presented in regards to the small and industrial power plants. There are a few small and/or industrial power plants on the territory of RS, but unlike the previously mentioned, there are no data attained. Basic information on existing thermal power plants on the territory of Republika Srpska is shown in Table 6. EPRS controls the thermal power plants taken into account here. These thermal power plants produce a total of 530 MV of available power. Due to existing technical problems, the projected power available at the threshold of TPP Ugljevik is 250 MV instead of the possible 280 MV which is currently not achievable as those technical difficulties restrict production. A reconstruction of the boiler would significantly contribute to the achievement of the possible projected power.

[2]HE Dubrovnik I is on the territory of the Republic of Croatia. The Power Utility of Republika Srpska and Hrvatska elektroprivreda share the HE Dubrovnik I production in the ratio 50:50.

Table 6. Existing thermal power plants on the territory of Republika Srpska

Republika Srpska- Existing thermal power plants						
Unit name	**Net capacity [MW]**	**Coal**	**Heat value of fuel [kJ/kg][a)]**	**Fuel price [EUR/GJ]**	**Heat rate [kJ/kWh]**	**Retirement [Year]**
Gacko 1	255	Lignite	8000	1.45	11520	after 2017.
Ugljevik 1	235.6	brown coal	10200	1.62	11470	after 2020.
Total ERS	**490.6**	**-**	**-**	**-**	**-**	**-**

Source: Energetski institut Hrvoje požar, Ekonomski institut Banja Luka & Rudarski institut Tuzla, *Studija energetskog sektora BiH, Konačni izvještaj*, 2008, p. 22, Table 3.4

TPP Gacko and TPP Ugljevik are scheduled for revitalization that will, not only prolong the lifespan of these facilities, but it will also fulfill standards concerning the protection of the environment by controlling the emission of polluting substances such as particles, sulfur and NO*x*. All operations of the revitalized units are expected to end no later than 2020.

5.3.2 Power plant candidates for construction

Candidate power plants in B&H are concisely overviewed in the following segment. The data provided here reflect solely upon the power plants whose data is derived from previous activities in a certain project, detailed studies on their (pre)feasibility and possibilities of exploitation of available water causes or coal mines, which is considered a relatively large final amount of candidates adequate for observation.

This observation also includes certain thermal power plants whose investment data are unfamiliar and that were therefore subject to the comparison of data regarding generic power plant candidates examined in the GIS study[3] of other sources elaborating expected investments within production facilities. As far as the candidates for hydroelectric power plant construction are concerned, the existence and operation of many so called joint facilities influence water courses among neighboring countries and entities.

Even though these facilities are mentioned below, the unresolved issues and unknown positions of these candidates presents an obstacle for seriously considering them and thus the interested parties should take part in settling these matters through direct negotiations and agreement.

[3] GIS study stands for Generation Investment Study.

5.3.2.1 Federation of Bosnia and Herzegovina

Basic information on hydroelectric power plant candidates on the territory of FB&H is shown in Table 7. The table presents the average net electricity production that is possible; measuring the threshold availability of electricity. The territory of EP B&H was the chosen location for carrying out the monitoring of ten project candidates for construction.

Table 7. Candidate hydroelectric power plants on the territory of the Federation of Bosnia and Herzegovina

Federation of B&H					
Elektroprivreda B&H					
Name	**Net capacity**	**Expected yearly production**	**Useful reservoir content**	**Specific investment, EUR/kW**	**Duration of construction, / Year**
	MW	**GWh**	**GWh**		
Small HE EP B&H	~ 100	~ 380	0.0	1439	2
Unac	71	250	29.3	963	3
Ustikolina	59	255	0.1	1396	4
Vranduk	22	103.2	0.0	2111	4
Glavatičevo	171.8	295	48.3	1048	5
Vrhpolje	68	157.4	9.8	1562	4
Čaplje	7.7	56.8	0.1	2845	4
Goražde	60	234	0.35	1500	5
Ključ	49	211	-	1714	4
Konjic	121	290	12.1	1074	5
Total EP B&H	**732.1**	**2232.2**			
EP HZHB					
Mostarsko blato	60	167	0.4	1200	4
CHE Vrilo	52	92	16.3	1149	5
CHE Kablić	52	73	20.6	1437	5
Han Skela	8.5	36	0.7	1500	5
Vrletna Kosa	25	63	34.7	1500	5
Jajce II-expansion (HE Ugar Ušće)	15	60	0.3	1500	5
Small HE HZHB – T-M-T basin	19.9	127.7	0.0	1881	2
Small HE HZHB – Lištica basin	7	27.7	0.0	1832	2
Small HE HZHB – Upper Cetina basin	12.7	30.7	0.0	1650	2
Total EP HZBH	**252.1**	**677.1**			

(table continues)

(continued)

Intrade Energija d.o.o., Sarajevo					
PHE Bjelimići	600.0 (-600.0)	1029 (-1388)	-	388**	4
Bjelimići	100.0	1335.4 (-1388)	0.0	1660	5
Total Intrade Energy	700.00	1335.4 (-1388)			
Small HE in Federation B&H with granted concession					
Small HE FB&H	~ 140	~ 430			
Total FB&H	1824.2	4674.7 (-1388)			

Source: Energetski institut Hrvoje požar, Ekonomski institut Banja Luka & Rudarski institut Tuzla, *Studija energetskog sektora BiH, Konačni izvještaj*, 2008, p. 28, Table 3.9

Another candidate is PHPP Bjelimići. It is a pump storage hydroelectric power plant – consumes a total of 1388 GWh during pump feeding operation mode and appears as a net consumer of electricity. It does hold a capacity of 2x300 MV and is expected to annually produce 1028 GWh.[4]

Furthermore, apart from Croatia and Serbia (neighboring systems) both having these sorts of plants, the territory of B&H also has a pump-storage within it (PSPP Čapljina – 400 MW capacity).

Following an increase of the number of constructions of intermittent sources, i.e. wind farms, there will be an increase in necessity for power plants offering a quick power change (regulation), more precise meaning pump storage hydroelectric power plants.
The organization of the balance energy market meaning the electricity market needs to be carried out in accordance with this. Concerning projects situated at the inter-entity line, such as HPP Vrletna Kosa and HPP Ugor Ušće the governments of the two entities, FB&H and RS have agreed upon a joint construction of the mentioned hydroelectric power plants.

The basic information about thermal power plant candidates located on the territory of FB&H is shown in Table 8. Within the territory of EP B&H there were a total of seven thermal power plant locations taken into consideration.

[4]Whether the construction and operation of a pump-storage hydroelectric power plant is justified or not, this is not a subject of this study, but can determined by an hour-by-hour analysis of operations a system load diagram.

Table 8. Candidate thermal power plants on the territory of the Federation of B&H

Federation of B&H - Existing thermal power plants					
Elektroprivreda B&H					
Unit name	**Maximum power [MW]**	**Coal**	**Heat value of fuel [kJ/kg]**	**Fuel price [EUR/GJ]**	**Heat rate [kJ/kWh]**
Bugojno 1	350 (320)	Lignite	10600	1.48	10239
Tuzla G7	450 (411)	Lignite	9500	2.30	8511
Kakanj G8	250 (230)	brown coal	13600	2.30	9000
Kakanj B	450 (411)	brown coal	13600	2.30	8511
Tuzla B G1	500 (465)	brown coal	10800	2.30	10680
Kamengrad G1	215 (195)	brown coal	11700	2.30	9000
Tuzla G8	450 (411)	Lignite	9500	2.30	8511
EP HZHB					
Kongora	**275 (265)**	Lignite	**7380**	**1.53**	**9300**

Source: Energetski institut Hrvoje požar, Ekonomski institut Banja Luka & Rudarski institut Tuzla, *Studija energetskog sektora BiH, Konačni izvještaj*, 2008, p. 30, Table 3.11

Given that only expected installed powers were known for Tuzla G7, Tuzla G8 and Kakanj B these three candidates share virtually identical characteristics. Much of the data, i.e. data on investments, certain expenses and specific heat consumption is assumed. A particular problem lies in the fact that the levels of analysis vary for individual location (existing and new) – something that greatly contributes to the uncertainty of coal prices and the specific investments on new locations in accordance to the existing locations. These uncertainties are perceived to be around 30%. Having attributes, preconditions and advantages such as physical plans and existing personnel is something that gives Tuzla and Kakanj the upper hand in comparison to new locations. On Tuzla and Kakanj locations, the existing blocks also ensure thermal energy for industry and households so it is necessary to consider the end of operations of existing blocks and the construction of alternative production capacities. The EP HZHB territory has been taken into consideration as a suitable location for the possible construction of TPP Kongora. The EP HZHB territory has been subject to research when it comes to a number of potential wind farm locations. The type of a wind farm that was considered was a generic wind farm with an installed capacity of 50 MW due to the specific configuration of a single wind farm which consists of a large number of wind powered generators connected into one system.

5.3.2.2 Republika Srpska

The basic information on the hydroelectric power plant candidates on the territory of the RS is shown in Table 9. An expected yearly production of 2945 GWh was considered, with each of the 15 projects holding a total capacity of 1167, 6 MW. Several groups which have a total power of 281, 7 MW contain small HPP projects. EPP RS and HEP (Croatia) joined together in the planning of HPP Dubrovnik II. The share that would belong to RS (50%) is

shown in the Table. Another joint project of the RS is the one with the FB&H – HE Ugar Ušće which has a planned capacity of 40 MW with the shared ratios of both sides involved being 50%-50%. Along with the facilities that are listed in Table 9, Lower Sutjeska is another hydroelectric power plant that has been considered for construction as a part of the Lower Drina project but has not was carried out as there has not yet been a technical solution defined (Studija energetskog sektora BiH, 2008).

Table 9. Candidate hydroelectric power plants on the territory of Republika Srpska

Unit name	**Maximum power at threshold [MW]**	**Expected production, [GWh/y]**	**Useful reservoir size, [GWh]**	**Specific investment, [EUR/kW]**	**Duration of construction, [Years]**
Small HE on RS territory	281.7	740	-	1750	2
Buk Bijela	132	350	20.0	2121	4.5
Foča	56	199	0.2	1512	4
Dabar	160	271	42.7	1049	4.5
Bileća	36	117	3.9	1417	3.5
Dubrovnik 2	152	159	6.5	1153	4
Nevesinje	60	101	54.1	2027	5
Krupa	49	140	0.3	1528	5
Banja Luka low	37	187	0.5	2316	5
Novoselija	16	70	0.1	1559	2.5
Paunci	42.3	160	-	-	-
Mrsovo	43.8	165	-	-	-
Ulog (Nedavić)	32.8	75	-	-	-
Ugar ušće – 50%	20	-	-	-	-
Ključ*	49	211	131.1	2998	4
TOTAL	1167.6	2945			

Source: Energetski institut Hrvoje požar, Ekonomski institut Banja Luka & Rudarski institut Tuzla, *Studija energetskog sektora BiH, Konačni izvještaj*, 2008, p. 32, Table 3.14

Another project that is under construction is the Upper Horizons project which includes the hydroelectric power plants of Dabar, Nevesinje and Bileća. The project holds a total investment of $8x10^6$ EUR, which includes expenses for measurements, tests, surveys, studies, projects, obtaining consent, construction of the Fatnik field tunnel – Bileća reservoir, construction of the Dabar field – Fatnik field tunnel, etc. The production of electricity is increasing in the downstream systems thanks to the construction of the Upper Horizons system. The facilities Buk Bijela, Foča, Pamići and Lower Sutjeska are all part of the Upper Drina project, which is scheduled for construction by the EP RS in cooperation with the Electricity Industry of Serbia. The start of operations for all power plants is to be carried out no later than 2018, with the exception of HPP Buk Bijela which should become subject to operations by the year 2015. Also, the power plants of Mrsovo and Ulog will most likely become subject to operations by the year 2013 (Studija energetskog sektora BiH, 2008).

Basic information about thermal power plant candidates on the territory of Republika Srpska is shown in Table 10. The following three locations were taken into consideration: Stanari, Ugljevik and Gacko. Regarding the power plants located on the territory of Gacko, the earliest possible years in which operations of two blocks (2x330MW) could start are 2015 and 2016. Pre-existing plans include both EP RS and ČEZ (Czech power utility company) in the realization of this project.

Table 10. Thermal power plants − candidates on the territory of Republika Srpska

ERS					
Unit name	**Maximum power [MW]**	**Coal**	**Heat value of fuel [kJ/kg]**	**Fuel price [EUR/GJ]**	**Heat rate [kJ/kWh]**
Ugljevik 2	400 (380)	brown coal	10200	1.62	9000
Gacko 2	330 (300.5)	Lignite	8100	1.57	9000
ETF Group					
Stanari	450 (411)	Lignite	9100	1.32	9230

Source: Energetski institut Hrvoje požar, Ekonomski institut Banja Luka & Rudarski institut Tuzla, *Studija energetskog sektora BiH, Konačni izvještaj*, 2008, p. 33, Table 3.16

Another project in which EP RS has realized cooperation is Ugljevik 2, this time with the American company AES (in which EP RS holds a share of 49%). This project was the subject of a pre-feasibility study. According to the study, operations should start no later than 2014. The government of the RS has signed a contract for construction concession due to the status of the TPP Stanari project in the first half of the year 2008. This power plant was in the contract, referred to as a merchant plan. This contract reflects on the possibility of all produced electricity being directed to the foreign market, mostly meaning the highest bidders – regardless of the fact that the power plant is going to be constructed on the territory of B&H. This is the primary reason for this power plant to be subject to a „double criteria „when it comes to assessing construction optimization determining whether the power plant produces mainly for the domestic market, or for export. The latest information, dating from August 2009 states that the preparation (ground) work is in progress (Studija energetskog sektora BiH, 2008).

5.4 Reform of B&H's energy sector – legal framework

After the post-war period, the legal and organizational solutions were ratified in B&H that balance the interests of all three constitutive peoples, which resulted in difficulties in applying the energy sector reform in accordance with the directives of the EU. The energy sector reform process had been initiated in 2000, and after the seven years long reform period, more than sixty ratified acts, five new institutions/subjects founded and more than fifty issued licenses, it can be stated that the planned effect failed to occur for the following reasons (Studija energetskog sektora BiH, 2008, p. 25):

1) The electricity market in B&H has not practically started working,
2) There are no new active commercial electricity companies,
3) There is no market-based prices forming,
4) There are no changes of suppliers,
5) All three electric utilities in B&H continue to have the market power in their region and there is no mutual market takeovers, no entrance to other markets,
6) There are neither active separations of production and distribution of electricity companies in FB&H, nor the activity separations of distribution and supplying in B&H,
7) The coal sector in F B&H has not been restructured ,
8) The efficient and transparent procedures for the choosing of new production facilities in B&H are not defined and harmonized.
9) The satisfactory system of socially threatened categories of buyers has not been established, etc.

The obstacles to the electricity market in B&H were spotted as follows (Studija energetskog sektora BiH, 2008):

1) Unfinished legal frame for electricity sector,
2) Incomplete market model defining,
3) The difficulties in market functioning,
4) The security of supply maintenance problem,
5) The public service regulation problem and socially threatened categories of buyers protection problem, and
6) Low electricity prices and low regulatory activities tariffs.

Electricity sector reform is based on the balancing of the legislation in B&H with the demands and directives of the EU in the energy, care of the environment, competition and renewable energy fields. To facilitate the ambient so that the electricity market in B&H becomes a unique economic area on all the territory based on the free and equal access to the portable and distributive web, is essential.

The founding of the regulatory body, that takes an important place in the electricity sector reforms processes around the world, including Bosnia and Herzegovina, is a result of the acknowledgment that security maintenance, reliability, non-discriminatory services with reasonable formed prices-policy must be established not related to the electric utility, which held a monopoly on all electricity activities.

Monopoly activities, such as transmission and distribution, regulating and subsidiary services enabling for the efficient work of electricity system, are the matter of supervisory body's complete regulation. The electricity production and ultimate buyers electricity supplying are being gradually liberalized by market mechanisms inclusion.

Two entity laws on electricity and Law on transmission, regulator and system operator of electricity in Bosnia and Herzegovina and the State Electricity Regulatory Commission in B&H together give bases of electricity sector regulation by three regulatory commissions.

State Electricity Regulatory Commission mainly regulates the Electricity Transmission Company, Independent System Operator and international electricity trade; two entity regulatory commissions (The Electricity Regulatory Commissions in Federation of B&H – FERK and The Electricity Regulatory Commissions in Republika Srpska –RERS) regulate the production, distribution and supplying with electricity.

Bosnia and Herzegovina has ratified the Founding the electricity community of South Eastern Europe Contract and thus accepted the appliance of the European Union directives on the electricity market, environment care, competition and renewable energy in the timetable established by the Contract.

According to Energy Community's "Statement on security of supply" (2007, p. 3), legal framework for electricity sector in Bosnia and Herzegovina is defined by:

- "**Law on transmission, regulator and system operator of electricity in Bosnia and Herzegovina** (*Official Gazette of BH, no. 7/02*);
- **Law on electricity in the Federation BH** (*Official Gazette of BH Federation, no. 41/02, 24/05 and 38/05*);
- **Law on electricity in the Republika Srpska** (*Official Gazette of RS no. 66/02, 29/03 and 86/03*);
- **Law on establishment Transmission Company in Bosnia and Herzegovina** (*Official Gazette of BH, no. 35/2004*); which established BH TRANSCO - the single transmission company in BH - "**Elektroprenos BH**", with its seat in Banja Luka;
- **Law on establishment Independent System Operator in Bosnia and Herzegovina** (*Official Gazette of BH, no. 35/2004*); which established ISO BH-Independent System Operator in BH, with its seat in Sarajevo."

The before mentioned laws identify the key entities for their implementation (Jenko, 2007, p. 6):

- "**The State Electricity Regulatory Commission** (established in 2004) – responsible for regulating transmission, transmission-related activities, and international trade. The State Regulatory Commission has its office in Tuzla.
- **The Entity Electricity Regulatory Commissions** responsible for regulating generation, distribution and supply, with the Federation Regulatory Commission's offices in Mostar and the RS Regulatory Commission's offices in Trebinje.
- **Independent System Operator (ISO) –** responsible for the management and control of the transmission network, directing, scheduling and coordinating maintenance, planning and development of the grid, development of the Indicative generation plan with the company for transmission of electricity (Transco). ISO

was registered in July 2005 and started operation in February 2006 when Transco was registered.

- **Electricity Transmission Company (Transco)** – responsible for transmission, maintenance and construction. Transco was registered and started operating in February 2006.
- **Ministry of Foreign Trade and Economic Relations (MoFTER)** – responsible for policy formulation in the electricity sector.
- Entity Ministries in charge of energy:
- Ministry of Energy, Mining and Industry of the Federation BH
- Ministry of Economy, Energy and Development of the Republika Srpska."

6 ELECTRICITY PRICES

The product or service price has a number of functions. Price that is being calculated for the consumer (the user of products/service) represents the base for the income formation with which the investor needs to break even the expenses of production/given service and to make a certain profit. The income level is at the same time the motive for investment in particular industry. Apart from that, the price stands for the special kind of language between the producer and consumer because it points out the capacity of certain product or service.

These price's functions are relevant for electricity as for all other products and services. However, electricity has some other peculiarities that should be taken into consideration during the price formation. Large capital investments, long development period and long energy capacity usage, along with the essential nature of this product, creates a need for such system of price formation that would give adequate signals to investors and consumers, for the purpose of achieving a healthy national economy creation.

Electricity prices need to be formed in the way that reaches a compromise between various expectations and interests. In which degree will the compromise be achieved depends on the possibility of common interests recognition and on measurement possibility and comparison of all relevant factors that contribute to their realization.

Theoretically, electricity price has several key functions:

1. to inform producers and consumers on real production expenditure, so they can make rational decisions (informative function),
2. to do income distribution as to meet the given criteria in primary distribution (distributive function),
3. enables the right producing factors allocation (allocative function) and
4. to rank energy entities according to business success (selective function).

The four named functions of prices stand for the theoretically ideal case of economic activity coordination trough market determined prices. However, there are a number of limitations, in practice, for complete realization of all functions. Therefore, one needs to

strive to electricity price that would, as much as possible, fulfill all the before mentioned functions.

6.1 Pricing on the electricity market

In electricity systems in which the monopoly on the electricity market is present, the vertically integrated company sets the price of electricity on the basis of costs of production, transmission, distribution and other costs of electricity supply.

Electricity prices could be determined by the state independent regulatory agency for the regulation of the electricity sector. The independent regulatory agency regulates a tariff methodology for pricing.

According to Regulatory Commission for Electricity in Federation B&H – FERK (2007), the aim of the tariff methodology is the formation of tariffs which are:

a) reasonable, non-discriminatory, based on objective criteria and determined in a transparent manner,
b) based on justified costs of operating and maintenance, replacement, construction, plant reconstruction, installation, and depreciation costs and taxes, taking into account the approved rate of return for the investments made, and taking into account the protection of the environment and customers,
c) formed to eliminate cross-subsidization between different industries and different categories of customers,
d) based on common international practice,
e) simple and understandable,
f) established to allow electricity companies adequate income flux that provides the insurance options for granted refunds, if those conduct their activities in an appropriate manner.

This method of pricing ensures the formation of a more realistic electricity price. Determination is performed several times a year, so that price fluctuations are minimal.

6.2 Electricity prices in a competitive electricity market

If there is competition in the electricity sector and on the electricity market, prices are determined by market mechanisms, based on supply and demand.

The process of determining the price of electricity in a competitive electricity market requires an understanding of the supply and demand formation method for electricity, and the influence of consumers, retailers and manufacturers of electricity supply and demand.

Since electricity is not a commodity that can be stored and it is consumed continuously every second, the demand for electricity in the short term is in the way of pricing- inelastic. Empirical researches show that the demand decreases when the price increases in the short term, but the effects of the price increase are extremely small.

If the costs of electricity consumers do not significantly affect its overall costs (whether it is a household or industrial producers), they will not reduce their consumption because of the sudden price changes, but they will adjust their demand in the long term.

Small consumers will buy electricity on the tariff basis, regardless of the degree of openness (competitiveness) of the market, because these tariffs isolate them from the daily price fluctuations. Because of this they have no significant influence on the creation of demand in the short term.

If consumer's demand for electricity in the daily peak load reaches several hundreds of kilowatts, then they can have a significant savings if they hire specialized traders to forecast their demand and for the supply of electricity on the market at lower prices. These are qualified buyers who purchase electricity on the wholesale market. Large industrial consumers and merchants-distributors make qualified customers, who purchase electricity for tariff customers (Hunt & Shuttleworth, 1996).

Manufacturers are willing to produce electricity if the market price is greater than the marginal costs of electricity production, with marginal costs defined as the costs of producing an additional unit of output. Therefore, the specific rules are needed for determining the price.

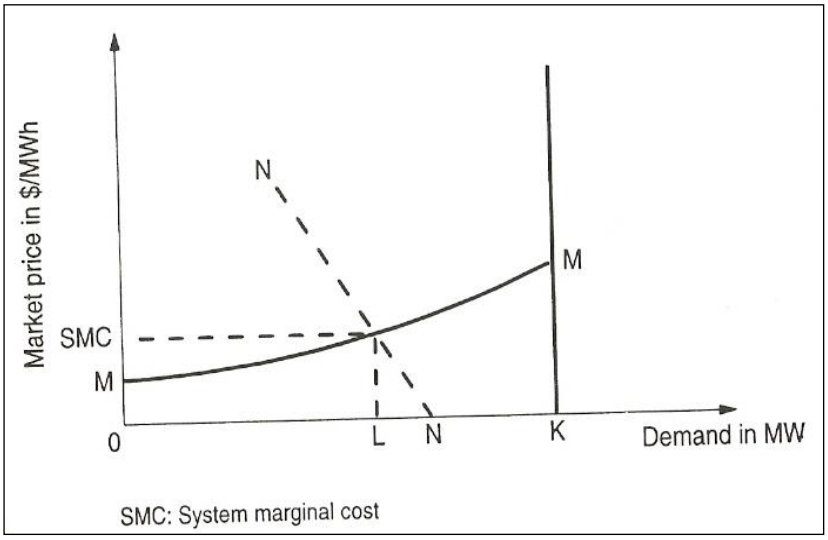
In model in which electricity is distributed over the pool, all manufacturers, pool members must disclose their production costs in order to ensure realistic pricing of electricity.

In a competitive market, the market mechanism is the only way to ensure a return on the cost of production, and that's why they have to exist rules for determining the prices on balance (spot) market. Prices on the balance market have a significant role in determining the prices at all other markets, or in any other contracts of electricity sale.

Marginal costs of additional output for the entire system are defined as the price offered by the most expensive manufacturer that produces electricity in the system. These costs are referred to as the system marginal costs (System Marginal Costs - SMC) or system marginal price (System Marginal Price - SMP).

Pricing in the system using the system marginal costs of electricity production can be presented graphically in Figure 3.

Figure 3. Pricing on electricity market



Source: S. Hunt & G. Shuttleworth, *Competition and Choices in Electricity*, 1996, p. 152.

On the horizontal axis the demand for electricity systems shown, and is expressed in MW. MM curve shows the marginal costs of all producers in the system. The system operator allows entering the system based on the rule that Manufacturers whose marginal cost lowest first distributing electricity, and as the demand increases, the expensive manufacturers also enter the system. The total capacity of the system is represented by point K.

In normal conditions, the demand for electricity can be presented with the declining curve NN. The market is in equilibrium at point L, respectively at the point in which the demand curve intersects the marginal costs curve. Thus, SMC can be defined as the marginal costs of the last producer who entered the system to meet the demand, and that those are the marginal costs of the most expensive producer.

To ensure the recovery of the costs of the production SMC must include variable and fixed costs of production. For example, the marginal costs of thermoelectric power plants should contain three elements (Hunt & Shuttleworth, 1996):

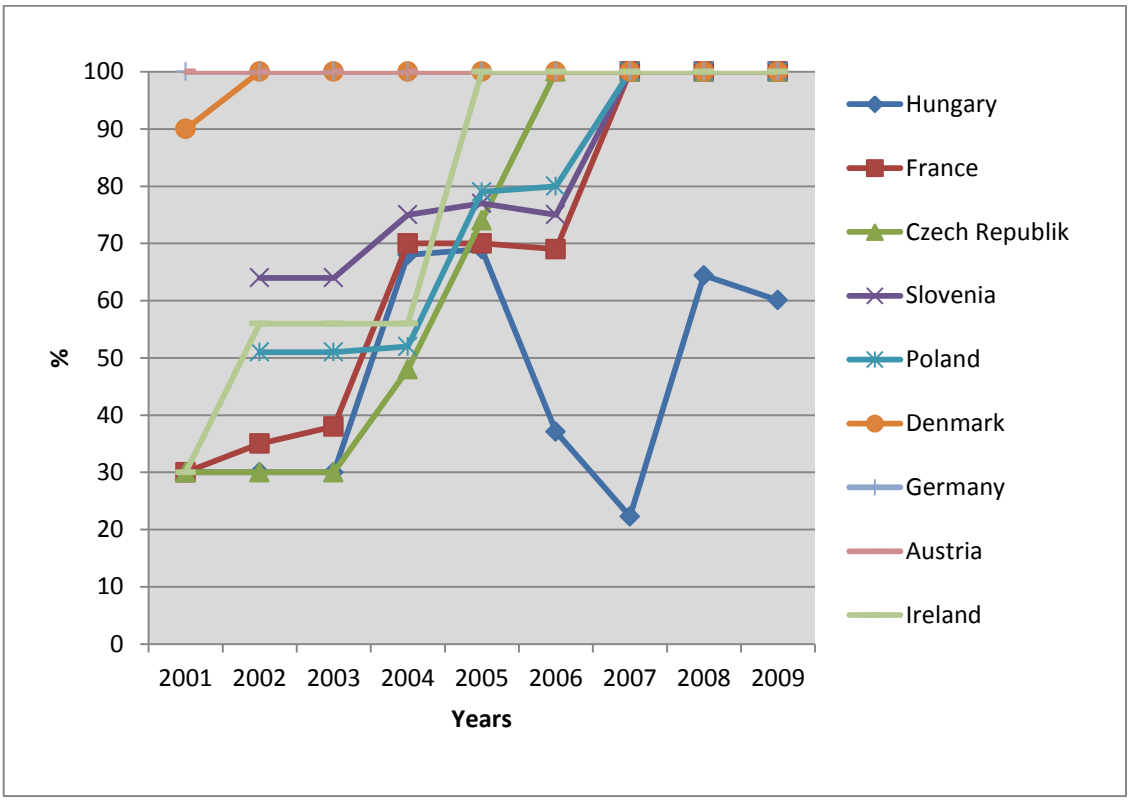
1. costs of starting the power plant block (start-up costs)
2. labor costs of the power plant block when power is connected to the system but without the load (no-load costs), and
3. other additional costs per MWh of actual production for different levels of output.

Balancing market price must be based on the total costs of production, so that producers could cover start-up and no-load costs, and generate income to cover the fixed costs of building and maintaining the plant. The only way to ensure open access to the electricity market is that price on the balance market reflects the total costs of production.

6.3 Electricity prices in the EU countries

The main question of this chapter is: does market liberalization, that is, introducing the competition to electricity market, affects the lowering of prices of this energy source? The research that Ernst & Young conducted showed that there is a correlation between electricity prices and competition in developed EU countries. Figure 4. shows dynamics of the electricity market opening in individual EU countries between 2001 and 2009.

Figure 4. Dynamics of the electricity market opening in EU countries 2001 – 2009



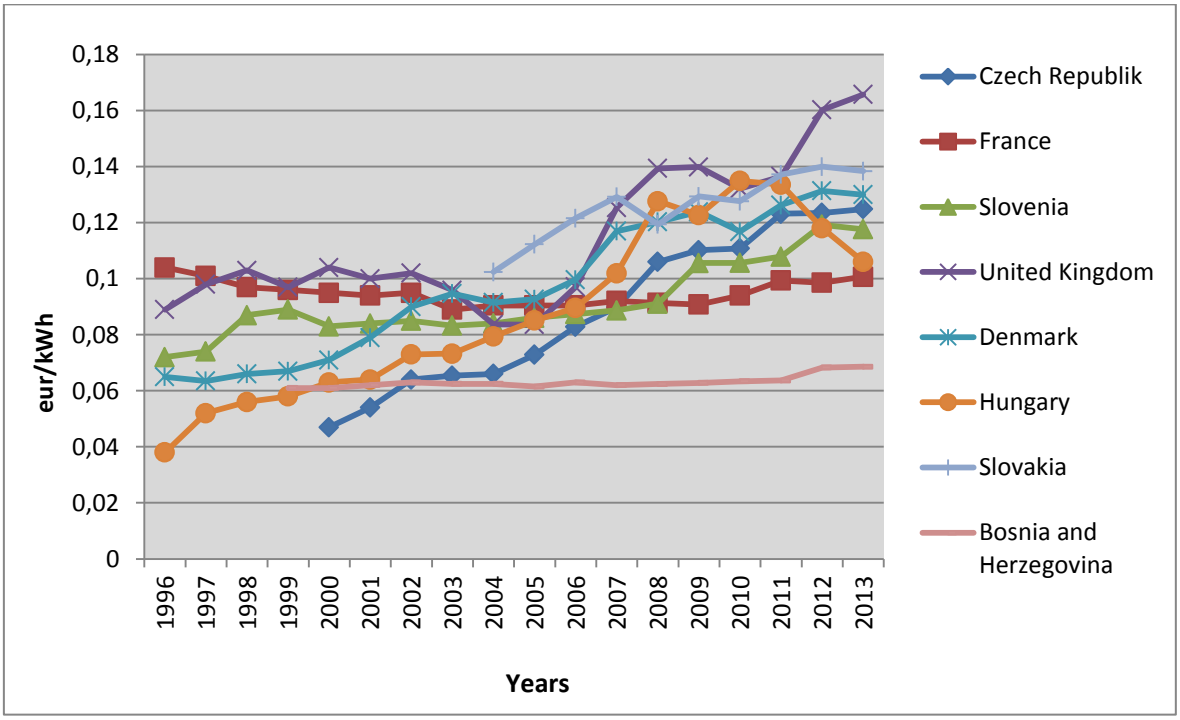
Source: *Eurostat*, 2013.

The degree of market openness is determined by the number of consumers who have the right to choose suppliers. We can see on the figure that there is an upward market opening tendency in presented EU countries. This tendency is the consequence of European Commission Directive appliance on creating the internal electricity market (Directive 96/92/EC and Directive 2003/54/EC).

All the observed countries, except Hungary, reached the full market opening by 2007. Bosnia and Herzegovina has not yet reached a considerable degree of openness of the electricity market and therefore it is not included in this part of study.

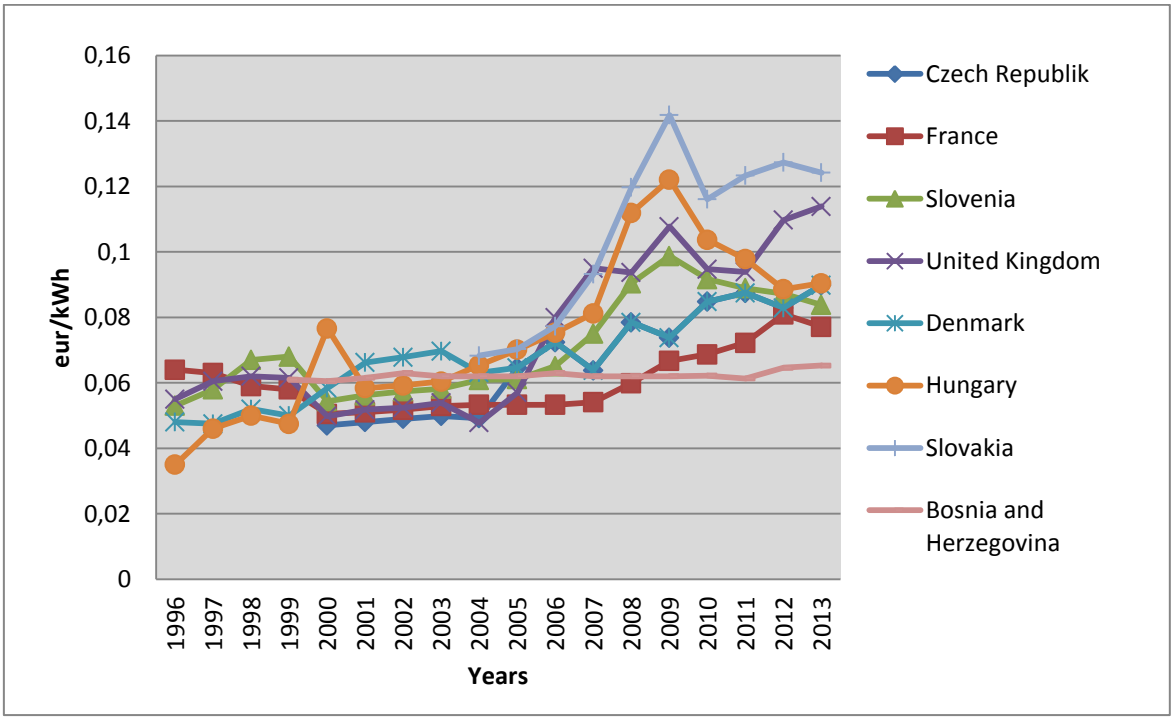
Figure 5. shows the electricity price fluctuation for households and the smallest consumers that are defined, according to Eurostat, as consumers whose total annual consumption is 3 500 kWh and nightly consumption up to 1 300 kWh.

Figure 5. Electricity price fluctuation for households and the smallest consumers from 1996 to 2013



Source: *Eurostat, Electricity prices for household consumers*, 2013.

Figure 6. Electricity price fluctuation for industrial consumers from 1996 to 2013



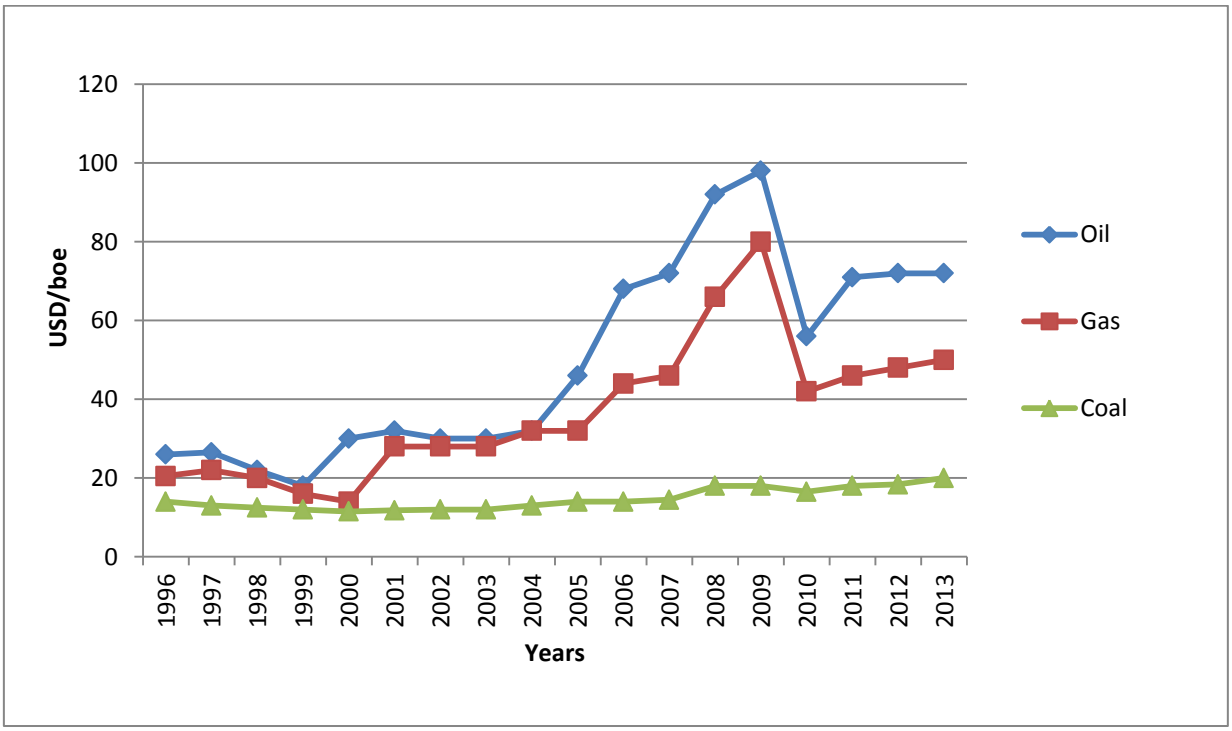
Source: *Eurostat, Electricity prices for industrial consumers*, 2013.

Figure 6. shows the electricity price fluctuation for industrial consumers, that are defined, according to Eurostat, as consumers with the annual consumption of 2 000 MWh, maximum demand of 500kW and annual load of 4 000 hours.

Electricity price fluctuation as shown on Figures 5. and 6. demonstrates the price's growth tendency, and it is especially emphasized after 2004. Obviously, electricity prices has reached the highest level in 2009. This upward trend may be a consequence of increase in prices of input energy in electricity production. The upward trend in the price of input energy in the world is shown in Figure 7. This analysis shows that the increase of gas prices and raw oil has resulted in electricity price rise.

The research that Ernst & Young conducted showed that there is a significant relation between liberalization and electricity prices for industrial consumers. It is proven that the electricity prices for industrial consumers decreases as the level of competition increases, where the level of competitiveness was determined by a composite indicator of competitiveness.

Figure 7. Prices of oil, gas coal in the world from 1996 to 2013



Source:*Eurostat*, 2013.

This research has been conducted only for the developed EU countries. Developing countries and countries in transition that joined EU after 2000 have not been taken into consideration.

Having the before mentioned research as a starting point, we can state that, even in those countries that weren't the main topic of the research, there were the same tendencies of market opening and electricity prices fluctuations. To show these tendencies, the shown empirical data have been gathered for the countries that have joined the EU after 2000. Data were shown for Czech Republic, Hungary, Poland, Slovenia and Slovakia. We will refer to these countries in the further analysis as EU 2000. The level of market openness in EU 2000 countries has an upward tendency, as with the developed EU countries.

The electricity price fluctuation for small and industrial consumers in the EU 2000 countries has the same tendency and price fluctuation in the developed countries. Electricity price for industrial consumers shows downward tendency in the period of 1999-2003, and in the period of 2004-2009 there was a rise of prices. This rise can also be explained with input energy price rise and growth of the producer's market strength.

Because of the same electricity price fluctuation tendencies and market's characteristics, as observed from the aspect of competition, we can conclude that in the EU 2000 countries there is a correlation between market opening and the decrease of electricity prices. Considering the fact that Bosnia and Herzegovina also accepted the European Commission directives on internal electricity market creating, it is interesting to analyse the electricity prices fluctuation in B&H in relation to electricity price fluctuation in EU countries. For that purpose, on graphs 5 and 6 the time sequence of electricity price fluctuation in FB&H in period from 1996 until 2013 has been added.

We should take into account that all electricity consumers in B&H belong to the tariff buyer’s category. There are certain differences in tariffs that households and industrial consumers pay. Prices given in the time sequence stand for the average price. If we observe the electricity prices for households and small producers, the price that these categories pay in B&H is considerably lower than those in European Union, especially in the 2004-2011 period.

If the time sequence of electricity price fluctuation in B&H is put in relation to the fluctuation of prices for industrial consumers in European Union, we can conclude that the electricity price is significantly more stable than the prices in EU. We also see that in 2009 prices were considerably lower in relation to the most EU countries. Based on these markers we can conclude that electricity market liberalization in B&H, as seen from the pricing aspect is not absolutely necessary, considering the fact that prices are notably lower than those in EU. Liberalization of electricity market in B&H will probably not lead to lowering electricity prices, but BiH cannot really avoid liberalization as it has committed to carry out the electricity reforms.

CONCLUSION

This thesis researches the electricity sector in European Union countries and Bosnia and Herzegovina. Particular attention was given to reforms of electricity sector and liberalization process. Electricity sector reform is based on the balancing of the legislation in B&H with the demands and directives of the EU. The energy sector reform process officially started in 2000, and still lasts because Bosnia and Herzegovina is a country with an atypical institutional structure and infrastructure, where even meaningless things become a burden with political and national dissidence (Rozić, 2009, p. 4).

Energy sector reform has often been used for earning political points by certain parties usually just before the elections, often letting the final goal of this process slip from their minds. That's why before applying themselves to any further process of reform, political parties, governments and all relevant institutions and their leaders must stop thinking of their own interests and instead work soly for the interest of B&H energy sector, truly opened and effective electricity market and, last but not least, interest of electricity consumers. (Rozić, 2009, p. 4).

In the past period, the reform of energy sector in Bosnia and Herzegovina has advanced largely. The largest achievements are the establishment of regulatory structure via three regulatory commissions, setting up the Single Transmission Company and Independent System Operator. However, energy sector still remains incomplete because of the delays that are frequently present in our country in all sectors. The fact that remained the same is the monopoly: three companies owned by the state still have it on generation, distribution and supply of electricity service. This is bad because it interferes with the interest of consumers and does not help in creation of healthy competition in this market. Separation of these companies didn't happen yet, and by that we mean separation in lawful terms or in a term of split accounts for each action. An enhanced system is needed in order to develop generation. In spite of some efforts being made by regulatory commissions, like making a structure in which every company intending to put up their own generation capacity has to register for authorization, before mentioned state companies are still dominant on the electricity market. Healthy competition is desirable, particularly having in mind smaller electricity generators and ones that produce electricity from renewable resources.

The major obstacle for B&H restructuring process to create single internal energy market and to join the regional energy market is the organization of the state under the Constitution (meaning a proper lawful state) concerning the energy matters. Affairs connected with energy are in the hands of entities:

- the problem is that there isn't any unified action plan on state level,
- where there should be an exclusive regulatory commission - three exist which makes it more absurd (one on a state level and two entity commissions),
- one of the great problems of the state is its growing need to fulfill international expectations and means by which the state would implement things which are

expected, efficiently, and that creates a big gap. Not having an effective mechanism and civil servants at both state and entity level is a serious and urgent issue to be resolved.

Everything is linked, for instance economical escalation in B&H is closely connected with structural changes in electricity sector, with modernization and new approaches to renew generation capacities and that is a serious goal for B&H to concentrate on in the future.

The reason that these reforms cannot take place just yet would be the absence of political conformity regarding the significance of making an up to date and efficient electricity sector in terms of technology, economy and functionality.

The liberalization of the electricity markets considered to be one of the most radical economic changes after the creation of the single market of the European Union. It is a long process that takes place gradually. The establishment of single electricity market includes a number of steps in the transformation of the centralized state-owned electricity utilities, through the gradual introduction of competition to the market opening for industrial consumers until the full market opening for all categories of consumers.

The following is expected from liberalization of electricity market:

- electricity prices lowering,
- level of services rising,
- the decrease of difference in prices among states,
- the possibility to choose supplier for every buyer and
- sector's efficiency increase trough reduced demand for making and maintaining spare capacities.

This thesis analyses and researches the extent to which the named goals of liberalization of electricity market are realistic and feasible, how successful is the shift of organizational structure of electricity sector from monopolistic towards competitive, meaning whether or not electricity market liberalization fulfills expectations.

Based on this research, prices of electricity and present situation in European Union countries and B&H's electricity sector it can be said that liberalization will not achieve the main goal for what it was set up, and that is to achieve the electricity prices lowering. The goal of equalizing the prices was not achieved also, because there is still a large price difference of electricity among states.

In Bosnia and Herzegovina there is no significant move of organizational structure of electricity sector from monopolistic toward competitive. The positive shift was made on quality of service uplift, sector efficiency increase trough lowered need for making and maintaining spare capacities and in formal market opening. These results of the research confirm the second hypothesis mentioned in introductory considerations which state that

de jure liberalization of electricity market in Bosnia and Herzegovina does not affect on the lowering of electricity prices for users.

In European Union market liberalization achieved the main goals of its appliance, electricity prices lowering, but it was short term results. In the long term, electricity prices in presented European Union countries are increasing. It can be concluded that the first hypothesis which state that market liberalization and the introduction of competition in the electricity market in European Union countries does not provide long term electricity price lowering is confirmed.

Furthermore, according to up today reform's state and according to the tendencies of those processes, the goals, the way they were originally imagined and mapped out, are not achievable.

REFERENCE LIST

1. Banovac, E. (2006). Metodološki pristup regulaciji javnih usluga u energetici (The methodological approach to the regulation of public services in energy). *Elektroenergetika 2*, 6-9.
2. Blumsack S., Lave B. L., & Apt J., (n.d.). *Electricity Prices and Costs Under Regulation and Restructuring*, Pittsburgh: Carnegie Mellon Electricity Industry Center (CEIC).
3. Bonneville, E., & Rialhe A. (2005). Impact of Liberalization of the Electricity Market on Energy Efficiency, Quality of Supply and Environmental Performance, Discussion paper, *Leonardo ENERGY*, Retrieved June 18, 2011, from http://web.aere.free.fr/documents_a_telecharger/ImpactLiberalization.pdf
4. Borenstein S., & Bushnell J. **(**2000). Electricity Restructuring: Deregulation or Reregulation? *Regulation 23*(2), Washington, D.C: The Cato Institute.
5. Centar za politike i upravljanje (CPU) (2010). *Izvještaj o politikama energetskog sektora u Bosni i Hercegovini 2010* (A report on the policies of the energy sector in Bosnia and Herzegovina 2010). Sarajevo: Centar za politike i upravljanje (CPU).
6. Cubbin, J., & Stern, J. (2004). Regulatory effectiveness: The impact of good regulatory governance on electricity industry capacity and efficiency in developing countries, *Discussion Paper Series 04*(04), London, UK: City University and London Business School, Department of Economics, School of Social Sciences.
7. Ekspertna grupa (2008). *Strateški plan i program razvoja energetskog sektora Federacije BiH* (The strategic planned program to develop the energy sector of the Federation BiH). Sarajevo: FMERI.
8. Energy Community (2007). *Statement on Security of Supply Bosnia and Herzegovina*, Vienna: Energy Community.
9. Energetski institut Hrvoje Požar, Ekonomski institut Banja Luka & Rudarski institut Tuzla, (2006). *Studija energetskog sektora BiH*, Početni izvještaj, (Energy Sector Study BiH). Sarajevo: Energetski institut Hrvoje Požar, Ekonomski institut Banja Luka & Rudarski institut Tuzla.
10. *Electricity prices for household consumers.* Retrieved October 16, 2013, from http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&plugin=1&language=en&pcode=ten00115

11. *Electricity prices for industrial consumers*. Retrieved October 16, 2013, from http://epp.eurostat.ec.europa.eu/tgm/table.do;jsessionid=9ea7d07e30eefb4f453fefb5450ca44d82beb9a8f330.e34OaN8Pc3mMc40Lc3aMaNyTaxmMe0?tab=table&plugin=1&language=en&pcode=ten00114
12. Energetski institut Hrvoje Požar, Ekonomski institut Banja Luka & Rudarski institut Tuzla, (2008). *Studija energetskog sektora BiH*, Konačni izvještaj, (Energy Sector Study BiH). Sarajevo: Energetski institut Hrvoje Požar, Ekonomski institut Banja Luka & Rudarski institut Tuzla.
13. Ernst & Young (2006). *Final report to the Department of trade and industry, Research project on „The Case of Liberalization"*. London: Ernst & Young
14. Fleten, S. E., & Lemming, J. (2003). Constructing forward price curves in electricity markets, *Energy Economics 25*(5), 409–424.
15. Filipović, S., & Tanić, G. (2010). *Izazovi na tržištu električne energije* (Challenges in the electricity market). Beograd: Ekonomski institut.
16. Hadžibegić, R., (n.d.). *Istraživanje iz oblasti energije* (Research in the field of energy). Sarajevo: Western Balkans.
17. Hall, D. (1998). *Electric Utility Cost Exercises.* Long Beach: California State University.
18. Hogan, W. W. (2008). *Electricity Market Structure and Infrastructure,* Acting in Time Conference Paper, Cambridge: Harvard University.
19. Hunt, S., & Shuttleworth, G. (1996). *Competition and Choices in Electricity,* Chichester: John Wiley & Sons.
20. Ilie, L., Horobet, A., & Popescu, C. (2007). *Liberalization and regulation in the EU energy market,* Unpublished research paper. Retrieved June 18, 2011, from http://mpra.ub.uni-muenchen.de/6419/
21. International Energy Agency (2005). *Energy Market Experience, Lessons from Liberalized Electricity Markets,* International Energy Agency, Organization for Economic Co-operation and Development (OECD). France: IEA Publications.
22. Jamasb, T. & Pollitt, M. (2005). *Electricity Market Reform in the European Union: Review of Progress toward Liberalization & Integration,* Massachusetts: Center for Energy and Environmental Policy Research.
23. Jenko, J. (2007). *Power sector development*, Background Paper, Athens: World Bank – 4th Poverty Reduction Strategies Forum.

24. Kahn, A. E. (1971). *The Economics of Regulation: Principles and Institutions*, New York: John Wiley and Sons, Inc.
25. Mulijagić, A. (2007). *Electricity market – road to Europe*. Sarajevo: International forum Bosnia.
26. Newbery, M. D. **(**2002). *Liberalising Electricity Markets,* Massachusetts: Center For Energy and Environmental Policy Research.
27. Nikolić, M., Mihajlović – Milanović, Z. Z., & Mandal, Š. (2003). *Ekonomika energetike* (Energy economics). Beograd: Ekonomski fakultet u Beogradu.
28. Omeragić, E. (2010). *Tržište i regulacija cijena električne energije* (Market and price regulation of electricity). Mostar: Naklada Hrvatskog leksikografskog zavoda BiH.
29. Osmanbegović, E., & Kokorović, M. (2010). Uticaj liberalizacije tržišta na cijene električne energije (The impact of market liberalization in electricity prices). *Ekonomska misao i praksa, 19*(2). Dubrovnik: Sveučilište u Dubrovniku.
30. PA Consultation Group (2001). *Bosnia and Herzegovina Power Sector Restructuring and Privatization Analysis and Action Plan*, Sarajevo: PA Consulting Group.
31. Regulatory Commission for Electricity in Federation BIH – FERK, (2007). *Electricity Market Opening in B&H, Restructuring of Power Sector and the New Energy Policy of European Union,* Tuzla: Regulatory Commission for Electricity in Federation BIH – FERK.
32. Rozić, A. (2009). *Legal framework of Bosnia and Herzegovina electricity market: Is there place for implementation of the third generations of EU energy directives?* Mostar, B&H: University of Mostar, Faculty of Law.
33. Šabanović, M., & Džizić M., (2010). *Electricity procurement opportunities for large costumers in Bosnia and Herzegovina*. Vilnius, Lithuania: August 25-28 2010, IAEE International Association for Energy Economics, 11th IAEE European Conference 2010.
34. Tominov, I. (2008). Liberalizacija tržišta električne energije – ispunjava li očekivanja? (The liberalization of electricity markets-whether it fulfills the expectations?). *Energija, 57*(3), 256-299.
35. Zhang, Y., Parker, D., & Kirkpatrick, C. (n.d.). *Competition, Regulation and Privatization of Electricity Generation in Developing Countries: Does the*

Sequencing of the Reforms Matter? Cranfield, UK: School of Management, Cranfield University.

36. Von Danwitz, T. (2006). Regulation and liberalization of the electricity market – a German view, *Energy Law Journal*, *27*(2), 423-450.
37. Vukić, Z. (2009). *Bosanskohercegovačka elektroenergetska privreda između strukture i politike – stanje i perspektive* (Bosnian economy between power structures and politics - state and perspectives). Sarajevo: Međunarodni forum Bosna – Centar za strateške studije, Centar za regionalnu suradnju.
38. Zakon o električnoj energiji *Službene novine Federacije BiH,* 41/02. Official Gazette of BH Federation, no. 41/02.
39. Zakon o električnoj energiji *Službene novine Federacije BiH,*7/02. Official Gazette of BH, no. 7/02.
40. Zakon o prijenosu, regulatoru i operatoru sustava električne energije u BiH *Službeni glasnik* BiH 13/03. Official Gazette of BH, no. 13/03.
41. Željko, M. (2009). Mogućnost razvoja elektroenergetskog sektora u Bosni i Hercegovini (The possibility of development of power sector in Bosnia and Herzegovina). *Energija 58*(4), 334-359.