

Characteristics of Deregulation Process with Respect to the Electric Power Market in Croatia

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Abstract: - In accordance with electric power sector deregulation in the Republic of Croatia, package of Energy laws that regulate energy activities regulation implementation was accepted. This paper outlines the characteristics of deregulation of the Croatian electricity market, with a special emphasis on the two possible regulatory orientations with respect to the electricity market; the role of the regulatory body is quantification of service parameters to insure electricity quality, and the principles of modern energy activities regulation approach. The paper emphasizes the importance of enactment of Tariff structure for services in electric power activities provided as public services. The new tariff structure classifies customers into classes, a developed structure of electricity prices and five tariff models, depending on the particular customer class. The regulatory approach, i.e. how to determine the fees for the use of transmission and distribution networks, and the suitable formula for determination of the annual revenue in the distribution of electricity are described as well.

Key-Words: - Deregulation, Electricity market, Energy Activities Regulation, Regulatory Body, Tariff System

1 Introduction

During electricity market model selection, adequate for situations in some countries, we must determine problematic electric power (EP) activities where competition cannot be established spontaneously. In national power sectors the EP activities have to be monitored by independent regulatory institutions, i.e. specific regulatory agencies (further in the text: Regulatory bodies). On the other hand, other electric power activities have to leave market regulation open, i.e. the process of liberalization. In order to understand the process better; definitions of most important terms are presented first:

- Restructuring means changing of organization and economic relations with purpose of increasing business efficiency and decreasing the costs.
- Privatization in power sector unblocks governmental capital invested in power sector development and invests that capital in other projects important for public sector.
- Liberalization means that the customer is free to choose a supplier including available access to electric power network.
- Deregulation is the process of shifting the government regulation elements and monitoring the prices of certain goods to market initiative.

Sometimes the term deregulation leads to the wrong conclusion because the market liberalization requires certain regulation degree. Generally, regulation is, in the case of regulated markets without competition, always focused on electric power supply and corresponding prices. In the case of liberalized markets, regulation is focused on prevention of market power misapplication. For distribution of electricity and transmission of electricity it is necessary to use regulated approach, because both are Public Service Obligation - PSO¹ and come under Regulatory bodies legislative. In power engineering PSO pays particular attention to power industries with emphasis on monitoring and care of government to protect customer interests and to ensure electric power supply security.

2 Electricity market Liberalisation

In the east and southeast Europe liberalization is established and the process of electricity market opening has been increased greatly. This process is continuously improved based on EU experiences and leads to elimination of national power system monopoly.

¹ Public Service Obligation, or Universal Service Obligation, or Customer Service Obligation.

2.1 Regulatory orientations with respect to the electricity market

Regulation orientation rules are crucial for successful implementation of explicit regulatory policy, and it has influence on regulatory mechanism configuration. Two basic regulation orientations are possible [1]:

1. In respect to subject of regulation.
2. In respect to power market.

2.1.1 Rules in respect to regulation subject

There are two basic regulation rules:

1. Regulatory body regulates providers, i.e. power companies on market.
2. Regulatory body never regulates consumers. They are under government jurisdiction through legislative where prescriptive rights and duties are described, including realization of some forms of tax policy.

2.1.2 Regulation rules in respect to power market

There are following basic regulation rules:

1. Long term strategic aim of modern market is deregulation, not regulation.
2. Ideal market² needs no regulation, it is deregulated, because it has some kind of "self control".
3. Quality of deregulation market improvement process is directly dependent on the degree of social development, technological advance and requires time and money.
4. Deregulation is a synonym for open market, and open market for competition which leads to quality product (service), and lower prices and better environment protection – strategic aim in the future.

2.2 Electric power quality

Essential question is the influence of deregulation process on quality of electricity supplied by public EP system. Sometimes EP company cutting could result in decreased level of EP quality causing short and long interruptions of the supply voltage, or bad voltage profile. Namely, competitions always cause reduction of employees in EP companies and sometimes it reduces investments in equipment and maintenance. At the same time, customer expectations increase in new business environment. Because of that, it is necessary that Regulatory body quantifies acceptable level of supplied electricity, and that includes:

- long term planning of investments with intention to replace or reconstruct network unsatisfactory parts,
- reliability calculations for transmission and distribution networks,

² Ideal market implies competition of technological progressive companies, based on principles of economics and with strict respect to ecological norms.

- detailed study of conditions for connection power plant or bigger consumers on network,
- network technical data base creation,
- predetermining parameters important for EP quality (permitted interruptions time, minimal number of consumers needed to reconnect after blackout in specified time, minimal level of voltage decreasing in specified time, period for meter replacement after changing the tariffs, etc.).

3 Croatian Regulatory Framework

The Croatian regulatory framework was brought in 2001 when five Energy laws [2] were accepted. At the end of 2004, due to harmonization with Directive 2003/54/EC concerning common rules for the internal market in electricity [3] new laws were accepted: Energy activity regulation law, Electricity market law and Amendments on Energy law [4]. Except the mentioned laws, during past three years, several dozen of regulations were accepted, with purpose to expand the legislative in energy area and performances of power activities on power market or public obligations. In the energy reform concept for regulation of energy activities, the Croatian Regulatory Body took modern approach (Table 1).

Table 1 Characteristics of modern and traditional regulating approach

Traditional approach	Modern approach
Dominant individual role	Joint responsibility
Inflexibility	Flexibility
Traditional steady procedures	Interactive processes
Control Body role	Influence realization
One dimensional	Multi dimensional
Consequent acting	Proactive approach
Principles based on old culture	Principles based on new culture

3.1 Activities of the power sector

In regard to the Croatian Energy law, energy prices can be free or regulated. Regulated prices shall be set by the application of tariff systems if not otherwise provided by the law. All electricity prices shall also contain the compensation for services provided by energy operators under PSO, carrying out the regulation of energy activities and stranded costs.

The Energy law stipulates next activities of the power sector generation of electricity (apart from electricity generation for eligible customers), transmission of electricity, distribution of electricity, retail supply of electricity (apart from retail supply of electricity for customers free to chose the supplier) as well as organization of the electricity market.

The prices of those activities shall be set by application of tariff systems and based on the following:

- Justified costs of facilities operation, maintenance, replacement, construction or reconstruction.
- Costs of environmental protection, taking into account a reasonable rate of return on investments in power plants, facilities and network or system.

In spite of that, the price of energy that is delivered to eligible customers³ shall be agreed and contracted freely with the supplier. Tariff systems for electricity have to ensure incentives for the promotion of energy efficiency and management of consumption, including the promotion of the use of renewable energy resources. The price of electricity for the same category of tariff consumers is equal all over the entire territory of the Republic of Croatia. With respect to the Croatian regulatory approach tariff systems shall:

- specify the elements for the energy price calculation,
- be able to specify different tariff amounts depending on type of customer, delivery period and seasonal or daily delivery volume fluctuations,
- determine the elements for setting the price of the connection to the power system or of an increase of connected capacity.

3.1.1 Tariff system for services in EP activities

In Croatia tariff systems shall be passed by the Croatian Government upon the proposal by energy undertakings on whose services the tariffs will be applied, based upon the opinion obtained from the Ministry and the Croatian Regulatory Body.

The new Tariff structure for services in EP activities [5] resulted in significant changes. Regarding consumer categories some changes are made in relation to prior tariff system, so that two consumption categories at 30/35 kV level and at 10/20 kV level are reduced to one category – Medium voltage consumers. That results in decreasing the difference between amounts to certain parameters for these categories of consumption.

In new tariff system, power (kW) has not been included into consumption category Low voltage consumers – residential and Low voltage consumers – non residential with connected power under 30 kW. Consumption category connected on 0,4 kV, which is in new tariff system in category Low voltage consumers – non residential is not classified into two tariff groups anymore (earlier the limit was consumption under and above 20000 kWh per year).

Customers are allowed to choose the model according to their load characteristic (one tariff measurement, two tariff measurement, installation of self payment Meter i.e. Meter with Magnetic Card Input) to Low voltage

³ In Croatia all customers with annual consumption exceeding 40 GWh are eligible customers.

consumers (residential and non residential). Furthermore, customers are allowed to change tariff model once a year, if the necessary technical conditions for measurement for new selected tariff model exist.

Table 2 shows elements of the new Tariff structure.

Authors of this paper suggest different distribution of customer categories, i.e. into groups of high voltage consumers and medium voltage consumers, as follows:

- transit or export customers: delivery at 400/220 kV (transmission customer supplies energy to the grid at 400/220 kV, and receives energy at 400/220 kV),
- the transmission customer who owns 110/x kV transformers – delivery at 110 kV (the transmission customer supplies energy at 400/220/110 kV, and receives energy at 110 kV),
- the transmission customer – delivery at 35/20/10 kV (this customer supplies energy at 400/220/110 kV or medium voltage and receives energy at 35/20/10 kV from 110/x kV transformers owned by the transmission company).

Table 2 Review of the main elements of the Tariff structure

MAIN ELEMENTS OF THE TARIFF STRUCTURE	
Categories of consumers	<ul style="list-style-type: none"> - High voltage consumers – 110 kV included and up - Medium voltage consumers – from 1 kV to 110 kV - Low voltage consumers – residential - Low voltage consumers – non residential - Low voltage consumers – public - Lightning
Parameters	<ul style="list-style-type: none"> - Demand charge – HRK/kW - Energy charge – HRK/kWh - Reactive energy charge – HRK/kVArh - Fixed monthly charge
Seasonal elements	<ul style="list-style-type: none"> - Higher season: Jan, Feb, Mar, Oct, Nov, Dec. - Lower season: all other months.
Daily tariffs	<ul style="list-style-type: none"> - Higher tariff; – winter 7 am to 9 pm, – summer 8 am to 10 pm - Lower tariff (the rest of a day)

3.2 Distribution and transmission of electricity

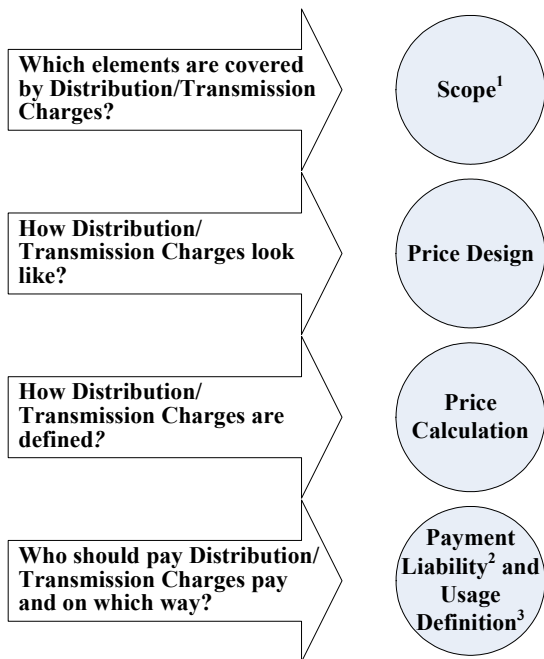
The structure of the distribution and transmission tariffs comprises several aspects, as follows:

- the format of the charges included in the tariff (fixed charges, capacity component and energy component),
- the level of geographical differentiation of the tariffs (nodal, zonal or uniform),
- the level of time differentiation (hourly, daily, seasonal, etc).

Despite to these universal rules the fact is that the distribution/transmission tariffs in European countries are very different. According to [6], EU countries in relation to transmission tariffs could be separated into three groups: low tariff countries (average transmission charge of about 4 €/MWh), medium tariff countries (average transmission charge of 7.5 €/MWh), and high tariff countries with transmission charge of 10 €/MWh.

Generally there are four basic questions and main steps regarding the procedure of distribution/transmission fees design (Fig.1).

Four Basic Questions and Main Steps
should be answered to design Distribution/Transmission Fees:



¹ Components of Distribution/Transmission Pricing.

² All participants should pay using of network.

³ kWh, kW or fixed charge.

Fig.1 The basic questions and main steps regarding the procedure of distribution/transmission fees design

3.2.1 Rules for determining distribution and transmission fees

TSO should prepare plans for the development and construction of the transmission network for a 3-year period, in cooperation with the system operator carrying out electricity transmission, which are subject to prior approval by the Croatian Regulatory Body. Those plans shall comply with the Energy strategy and its Implementation program. This is important because the electricity transmission fee will be set on the basis of network development and construction plans. In case that a producer and a customer intend to conclude a contract on electricity delivery and/or supply, and cannot obtain access to the network, they can construct a direct line, subject to the Croatian Regulatory Body approval.

Anyway it is essential for Regulatory Body to define transparent criteria for determining amount of transmission/distribution fees, as follows: share for the use of transmission and distribution network, share for the ancillary services, share for coverage of technical losses occurring for electricity transmission/distribution.

If determined by law, certain possible additions could be: fee for the Regulatory Body's activities, fee for the system and market operators' work, dispatch of eligible production, bonus to stimulate eligible producers, recording contracts on an organised electricity market, and additions for coverage of stranded costs.

Regarding the Law on electricity market (Article 12) the Croatian Regulatory Body shall set fees for electricity transmission/distribution upon the proposal of the energy undertaking, carrying out transmission or distribution of electricity, respectively.

The Croatian Regulatory Body stipulates the Regulation on method and criteria for determination of the amount of the fees for use of transmission and distribution network [7]. This Regulation is based on the Non-Transaction Stamp Method (system of single calculation of the use of networks regardless of the length of transmission or distribution line, and regardless of the number of individual transactions). Those fees are defined in compliance with the following goals:

- transparency and non-discrimination,
- being based on eligible costs of operation, facilities, maintenance, replacement, network construction or reconstruction and environment protection, including a reasonable period for return of investments,
- stimulating the mechanisms for improvement of consumption management and energy efficiency, including the increased use of RES,
- stimulating the efficiency of energy undertakings for electricity transmission and distribution, or users of network, based on the principle of regulated access and fee for the use of network,
- transparency related to the use of transmission and distribution network and their integral parts,
- creation of stable relations on the electricity market and stable conditions for investors,
- separate setting of fees for the use of network,
- provided that for a specific category of consumption categories the fees are equal all over the country,
- separate determination and expression of fees for specific network and/or system services (except for such system services for which a specific electricity market is organised),
- stimulating development of transmission and distribution network so that the quality level of delivery is constantly maintained or increased,
- fees must ensure funds for the required development of transmission and distribution network.

3.2.2 Forecasting EP distribution annual revenue

Generally, it is necessary to point out that Regulatory Body develops and elaborates the methodology for estimation of total annual revenue of regulated power companies. This must include: operational costs, maintenance costs, depreciation costs, network losses costs and rate on return to operating assets.

From regulation point of view it is very important to define criteria for permitted amount of annual revenue EP distribution service, not only because this activity is carried according to PSO rules, but because it contains a very large number of consumers. Generally speaking it concerns next steps necessary to be carried out during tariff analysis for EP distribution activity (Fig.2).

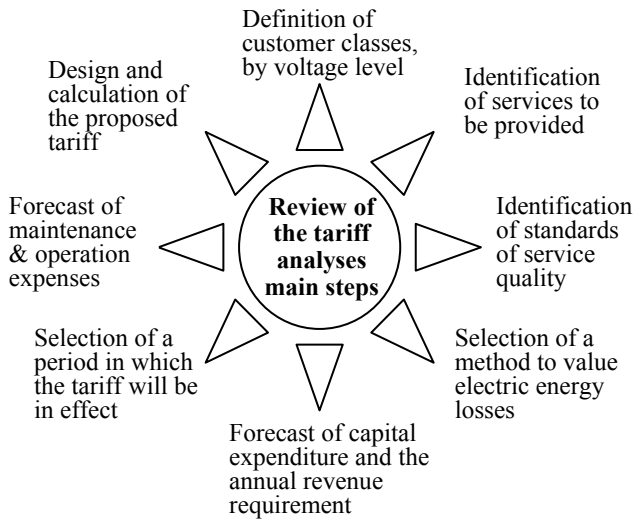


Fig.2 Steps needful for distribution tariff analysis

Beside steps shown on Fig.2 in order to define annual revenue in electric power distribution, Department for tariff of Regulatory Body should determine:

- setting of financial objectives,
- forecast of the annual revenue requirement.

These steps are necessary because the calculations of target amount of annual revenue of EP distributors are used by Regulatory Body for accounting grid fee for EP distribution.

For monthly calculations, in order to verify target revenue amount realization, are necessary to:

1. Regulatory Body defines regulation period in years, during which level of the annual revenue for EP distribution service is calculated.
2. Regulatory Body ratifies level of annual revenue for EP distribution service for every year of regulation period, in real amounts.
3. After expiration of every month, in the seven days period, EP distributor has to deliver to Regulation Body estimation of interruptions of supply voltage duration in minutes per connected customer and estimation of distribution network losses in GWh.

Data could be delivered for previous month and for the period of previous twelve months. Regulatory Body could collect these data by using mechanism for data acquisition of usual regulatory monitoring. In Croatian EP sector it is carried out in accordance to the rules described in [8].

It is possible to calculate target amount of permitted annual revenue – R_t for EP distribution services in year t from this expression:

$$R_t = A \cdot B + C \quad (1)$$

Particular parts of formula (1) could be as follows:

$$A = 1 + CPI_t - X_t \quad (2)$$

$$B = F_t + P_L \cdot (AL_t - L_t) + P_{CML} \cdot (ACML_t - CML_t) \quad (3)$$

$$C = \Delta R_{t-1} \cdot (1 + K_t) \quad (4)$$

Where (alphabetically):

$ACML_t$ – permitted number of interruptions of supply voltage in minutes in year t , determined by Regulation Body,

AL_t – permitted distribution losses (MWh) in year t , determined by Regulation Body,

CML_t – realized averaged number of interruptions of supply voltage in minutes in year t ,

CPI_t – variation of consumption prices index in period from starting null year to year t ,

F_t – objective annual revenue t , in Croatian Kunas (including forecasted business total expenses of EP distribution company),

K_t – rate prescriptive by Regulatory Body (ensure that values of additional revenues collected from customers in year t is equal to part of annual revenue which EP distributor has the right to collect, but he did not in year $t-1$),

L_t – real losses in distribution network (MWh) in year t ,

P_{CML} – value granted to minutes of interruptions of supply voltage in Croatian Kunas/minutes (financial reward to EP distribution company when minutes of interruptions of supply voltage are under permitted level, or financial penalty through lower distribution grid fees when minutes of interruptions of supply voltage are above permitted level),

P_L – distribution loss cost (Croatian Kunas/MWh),

X_t – efficiency coefficient defined by regulatory body,

ΔR_{t-1} – part of annual revenue which distributor has the right to collect, but he did not in year $t-1$.

In practice all values of particular parameters of formula for calculation of objective amount of annual revenue in year t , determined by some Regulatory Body are not constant, and depend on specific market and network characteristics of a particular country.

If L_t and CML_t are unknown it is possible to assume:

$$AL_t = L_t \quad (5)$$

$$ACML_t = CML_t \quad (6)$$

Using (5) and (6) into (3), objective amount of permitted annual revenue – R_t in year t will be calculated from:

$$R_t = F_t (1 + CPI_t - X_t) + \Delta R_{t-1} \cdot (1 + K_t) \quad (7)$$

Equitation (1) for objective amount of permitted annual revenue – R_t will in that case include correction based on real values of L_t and CML_t .

4 Authors' observations

For future analyses, for creation of efficient Croatian electricity market model, experiences of other countries should be known. There are interesting examples in neighboring countries, new members of EU, which opened their electricity markets to a large extent. Electricity market is opened 75% in Slovenia, 67% in Hungary [9], and at the same time in Croatia (year 2004) electricity market is opened only 9%. In Slovenia and Hungary all customers are free to choose a supplier, except residential category, in Croatia, that privilege is given only to customers with annual consumption above 20 GWh. It is evident that the process of electricity market opening in Croatia is slower than in progressive transition countries in the neighborhood.

To establish competitive electricity market in Croatia it is crucial to increase the number of producers and suppliers. At the beginning of 2005 there are only three producers (with dominant participation of one of them) and one supplier. To improve competition new Electricity market law is introduced which replaced ISMO concept (Independent System and Market Operator) with TSO concept (Transmission System Operator) including foundation of Independent Market Operator.

5 Conclusion

Rules of World deregulation process have influenced both electricity market and electric power sector in Croatia. In respect to new circumstances, implied by deregulation, Croatian legislature has been adjusted two times. First in the middle of 2001, when the set with five Energy laws was accepted, and after that at the end of 2004, new Energy laws are harmonized with Directive 2003/54/EC concerning common rules for the internal market in electricity.

Through that legislative energy activities regulation were reached, and since than (three years) the Croatian Regulatory Body has been applying regulating methods.

Particular attention was dedicated to electric power activities regulation, including cases that should abide market rules or Public Service Obligation – PSO rules.

Simultaneously, regulatory monitoring was implemented and rules for calculations the amount of the fees for use of transmission/distribution network were defined, including action rules of the electricity market. Those were the preconditions for more intensive opening of the Croatian electricity market (in 2004 market is opened only 9%) and its integration in the internal electricity market of the European Union.

In the described process it is important to develop regulation techniques and methods to stimulate further market opening, investments into electric power activities and competition improvement.

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