

Electricity Market Development and Security of Supply In South East Europe

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Abstract: - Even though perception of electricity assumes *the goods*, electricity is characterized by unique, specific simultaneous production and consumption with no possibility to bank up electricity efficiently. Besides, long time is needed for construction of power system elements and for return of investment, while electricity is constantly perceived as immediate public service. Market opening actualized question of supply security under new conditions. Number of market subjects dramatically increased, responsibilities are decentralized and consumer requests are significantly increased. Accordingly, the main market design task comprises optimal solution of supply security problem under new conditions between subjects with contradictorily targets. All power sectors in the region are going through turbulent processes of restructuring, market opening and privatization at the same time. Security of supply should be observed more carefully than ever on all three levels: national, regional and European.

Key-Words: - regional system specifics, electricity market, privatization, supply security

1 Introduction

Historically, South East European power system has never been connected in unified parallel operation until October 2004. Till 1995 Hungary, Slovakia, Czech Republic and Poland (CENTREL countries) as well as Romania and Bulgaria were not part of interconnected European grid (UCTE - Union for the Co-ordination of Transmission of Electricity). However, due to war damages in the region in 1991 Serbian, Montenegrin, part of Bosnian, FYR Macedonian, Albanian and Greek power systems in addition to Romanian and Bulgarian were separated from UCTE and in island operation in so called 2nd synchronous UCTE zone with its peak load of about 30 000 MW. Finally, in October 2004 UCTE reconnection was realized and power system conditions in South East Europe are dramatically changed. Moreover, at the same time power utilities are under process of deregulation and privatization. Due to post-socialistic collapse of industrial consumers South East Europe is characterized by surplus of installed generation capacities. On the other side some western power systems, especially Italian, are reaching its maximal production and highly depending on electricity import. Relatively cheap electricity from South East Europe became a great market opportunity and of utmost interest for different players as well as detailed evaluation and realization of power business in South East Europe that was not reachable so far due to monopoly in power sector and UCTE separation.

2 Problem Formulation

In that sense it is interesting to analyze initiative for establishing of regional energy market in South East Europe. Historically isolated and mutually different energy sectors in the region are jointly bringing high energy potential to EU. This paper gives an overview of electricity market in the region, power system specifics, joint regional centre organizations, advantages and disadvantages of regional market, influence on regional supply security, process of privatization and role of EU countries. All power sectors in the region are going through turbulent processes of restructuring, market opening and privatization at the same time. Security of supply should be observed more carefully than ever on all three levels: national, regional and European.

3 Energy Community

Recognizing the importance of the regional electricity market, the European Commission and the nations in the region launched so called *Athens Process*. Accordingly, electricity sector in South East Europe has a medium to long term regional reform plan, which is set out in the First Athens Memorandum of Understanding (MOU), signed 15 November 2002. Under this MOU, full member states form *Energy Community* and are obliged to implement national legislation creating electricity regulators and transmission system operators by

June 2003 and to open the market for all non-domestic consumers by June 2005. The second Athens Memorandum of Understanding (MOU) was signed in December 2003, practically postponing some previous obligations. The Athens MOUs commit the signatories to create a regional market that is to be integrated with the European market. This signed reform plan was extended to cover the natural gas market also under the Athens 2003 Memorandum of Understanding, which obliges full members of Energy Community to implement national legislation in accordance with Directives 2003/54/EC (electricity), 2003/55/EC (gas), 85/337/EEC (environmental impact assessment) 1999/32/EC (reduction of sulphur content of fuels) and 2001/80/EC (Large Combustion Plants). Legislation is required to be adopted by 1 July 2005 though the timetables for implementation may be later than those applying to EU Members.

Building on the signed Memoranda of Understanding the European Council invited the European Commission to enter into negotiations on a binding treaty establishing the Energy Community. Today, negotiations are still ongoing, approaching its final stage and the signing are expected to be realized before the end of this year. Until June 2004 this whole initiative was known as "The South Eastern Europe Regional Energy Market - SEEREM"

Accordingly, the Energy Community should include territories of the Republic of Albania, the Republic of Bulgaria, Bosnia and Herzegovina, the Republic of Croatia, the former Yugoslav Republic of Macedonia, Serbia - Montenegro, Romania, the Republic of Turkey, and the United Nations Interim Administration Mission in Kosovo (UNMIK) pursuant to the United Nations Security Council Resolution 1244. Observing countries in Athens process are Austria, Italy, Hungary, Slovenia and Moldova. In this way the development of the Regional Electricity Market is coordinated by the European Commission and the interim Energy Community Secretariat [1]. It is expected that all above mentioned countries will be part of regional electricity market.

The major commitments of the above mentioned process are:

- to create a regionally integrated energy market for electricity (and natural gas) networks and to integrate that market into the unified EU market,
- to bring national legislation of the member countries in line with EU energy legislation,
- to establish common rules for generation, transmission and distribution of electricity,
- to establish common rules for the transmission, distribution, supply and storage of natural gas,
- to establish state level national energy authorities, regulators and transmission system operators,

- to suspend monopolies in power sector production and supply,
- to establish compatible state and regional electricity and natural gas market action plans,
- embryonic regional level dispute resolution mechanisms,
- to open the markets in line with EU commitments but with a suitable transition period,
- unbundling of integrated utilities,
- authorization of transparent procedures for new infrastructure projects,
- an anti-corruption programme in power sector,
- to implement grid codes and other technical and commercial codes that are necessary for the functioning of the market,
- to regulate third party access, tariff systems that encourage trade and technical codes necessary for the operation of a trade based regional system (cross-border trade).

Simultaneously with the process, the benchmarking of implementation activities is taking place, which can be used both for comparison and stimulation of ongoing activities in regional countries.

Action Plans for long term implementation of the regional electricity market are being drafted at regional level by the Council of European Energy Regulators (CEER) and at national level by EuropeAid contractors on behalf of the European Commission for implementation from 2004. As always in this region, after all necessary preparing activities implementation and coordination are the most turbulent parts of the project.

4 Regional System Specifics

Starting problem in project realization appears immediately after screening of power systems and country economics. In this paper South East Europe region refers to Albania, Bosnia and Herzegovina, Bulgaria, Croatia, the Former Yugoslav Republic of Macedonia, Moldova, Romania and Serbia and Montenegro.

4.1 General data

It is a diverse region of about 60 million people, with a wide range of average income per capita going from US\$ 590 in Moldova to US\$ 5350 in Croatia. The past decade of transition and conflict left the region with a legacy of inadequate growth and declining living standards. Since the end of the

Kosovo conflict in 1999, however, there has been considerable improvement. Civil unrest has been overcome and a political balance has been found that has allowed a return to economic growth and closer regional cooperation.

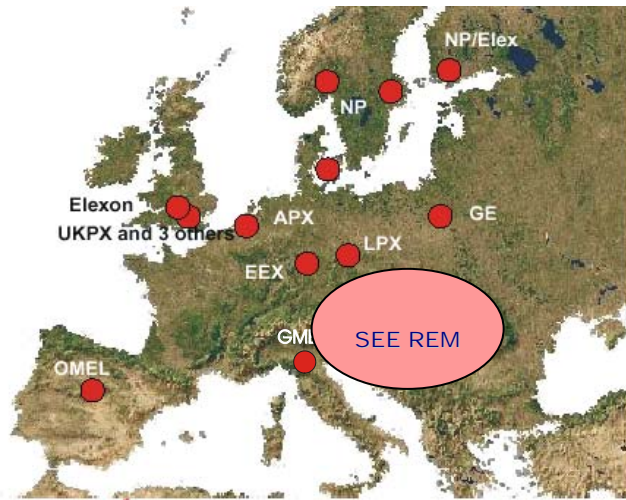


Fig. 1 Existing electricity markets in Europe and future SEE REM

For the Region as a whole, economic growth has been close to an annual value of 5 percent since 2000. Turkish economy has experienced a very high average annual growth of 5% for the past 20 years. Today average GDP/capita in the region is more than 7 times lower than EU-15 average. The following table presents characteristic country and power system specifics that prove large mutual differences in the region, including Greece (EU) and Turkey (EU candidate) as observing and influenced countries.

Table 1 Power system specifics in the region

Country	GDP/capita (US\$)*	demand/capita (kWh)**	peak load (MW)***
Albania	1740	1,66	1254
Bulgaria	2130	5,44	6468
BosniaHerzegovina	1852	2,19	1800
Croatia	5350	3,33	2760
Greece	13720	4,30	8897
FYR Macedonia	1710	3,61	1417
Moldova	590	0,76	1200
Serbia-Montenegro	1910	4,33	7296
Romania	2310	2,30	7542
Turkey	2790	2,09	21014
UNMIK	750	1,98	590
AVERAGE	3168	2,91	5494

* World Bank 2003

** Energy Regulatory Regional Association ERRA 2004

*** Annual Report Southeastern European Power Utilities 2003, EKC

These data show that GDP per capita in the region differ for 23 times (Greece/Moldova) or 9 times (Croatia/Moldova) between the countries. Excluding Moldova this share drops to 3 times (Croatia/Albania). These values present significantly different national economies that can (not) easily withstand all necessary changes in power sector such

as market opening, real tariffs, absence of state support to power companies etc. in the same timeframe. This is obvious disadvantage of unified steps to regional electricity market. But it should be overruled by the fact that no other solution exist for national power sectors but to join marketplace sooner or later. Also, in the beginning of 90's all power sectors started from almost the same level of state owned utilities organizationally inherited by the socialistic environment.

Differences in electricity consumption per capita are not so significant, though peak load are within wide range due to different country areas.

The following figure presents existing level of internal market opening in regional countries. Except Bulgaria, Croatia, Greece, Turkey and Romania market opening is still at very beginning. Also, these values assume declared market opening, while level of realized market eligibility is significantly lower. In that sense, there exists big difference in market operation. I.e. in Romania a day-ahead market and a balancing market are expected to be functional starting with July 2005, while in some other countries not even starting eligibility consumption is defined. Generally, internal market opening in the region is expected to rise significantly in next few years along with coordinated process of common regional market.

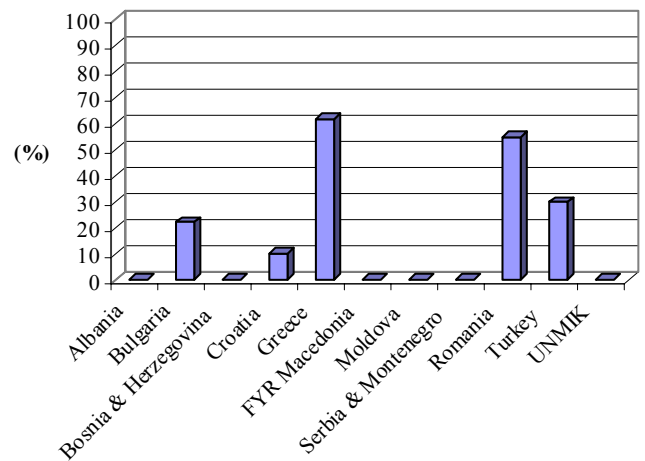


Fig 2. Existing level of declared market opening

4.2 Existing electricity prices

While speaking of future common electricity market it is interesting to analyze existing electricity prices in regional countries as shown in Fig. 3 [2]. Average residential electricity prices in the region in 2004 vary between 3.8 USc/kWh (Bulgaria) and 9 USc/kWh (Romania) with average value of 6.4 USc/kWh.

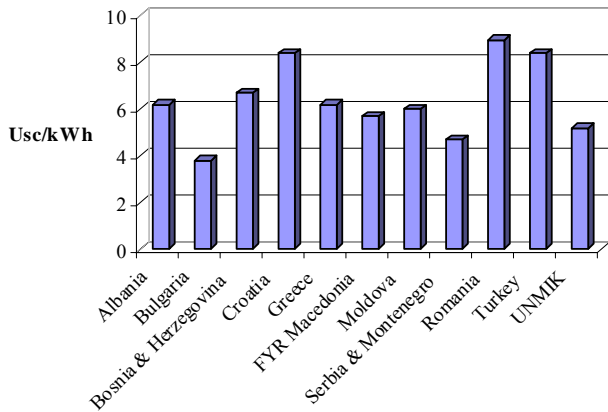


Fig. 3 Average residential electricity price (2004)

Obvious significant differences in existing electricity prices present good basis for market development. Consequently, organized electricity market will support higher level of electricity exchange in the region. Though all regional countries except Moldova and UNMIK declare surplus of installed generating capacities over peak demand, most of the countries constantly import electricity from abroad due to aged and expensive own production facilities. At the moment Bulgaria and Romania are the only countries in the region that are constantly having operating capacity surplus used for export.

5 Restructuring of Power Sector

Simultaneous process of market opening, power system restructuring and privatization is taking place in SEE Europe. After decades of non-changing environment in power sector, last few years are extremely dynamic in number of crucial changes in power sector organization and operation. All power utilities in the region were (are) in process of unbundling. Different models are chosen. In Romania, Bulgaria, FYR Macedonia, Turkey, Moldova and Serbia and UNMIK independent TSO is (will be soon) established, out of former vertically integrated company. These TSOs own and operate transmission system. In Bosnia and Herzegovina ISO model is established in which ISO operate but does not own transmission grid. In Croatia TSO is part of vertically integrated company, while in Albania the unbundling process started few months ago. Most of organization changes would need some more time to be finished.

6 Power Sector Privatization

Power sector privatization started in SEE Europe few years ago. The first privatization process was performed in Hungarian power system in 1995. Privatization process in all European transitional countries starts with distribution

companies, then generation companies, while transmission companies are mostly excluded from privatization.

Inert consumer reaction on market eligibility is the main reason for distribution company acquisition. While buying distribution companies investors are simultaneously buying supply business or, in other words, significant market share. Accordingly, investment risk is much lower. Similar reasons are valid for acquisition of generation facilities. It is interesting that in some countries privatization process started before the end of restructuring (Hungary, Bulgaria and Czech). Privatization process is most developed in Bulgaria and Romania. Privatization in Bulgaria started in 2002 with small hydro power plants. In 2003 there was first big foreign investment in electricity sector, in thermal power plant Maritsa East 3. In 2004 all six distribution companies were sold (66% of ownership) to foreign investors Czech ČEZ, German E.ON and Austrian EVN. In 2005 the process is continued in generation with 2300 MW of installed capacity offered on international privatization tender. Expected investments in Bulgarian power sector are far the highest in the region and are estimated to 4.14 billion € till 2007. In Romania four out of eight distribution companies were privatized in 2004. Investors are Italian ENEL, German E.ON and Czech ČEZ. Partial privatization of Transmission Company is under discussion and preparation in Romania. In Moldova three of five distribution companies were also privatized by Spanish Union Fenosa. In Macedonia first call for privatization of generation and distribution companies is also announced. In other countries in the region there was no significant power sector privatization activity, but it is expected very soon.

7 Regional Market Possibilities

Figure 4 shows share of installed hydro capacities in total hydro capacities in the region that is equal to 25055 MW. There is no Turkey on the figure since Turkey is still not connected to the main UCTE grid. Connection of Turkey to the UCTE is under preparation. The following figure 5 shows share of installed thermal generation capacities in total thermal capacities in the region that is equal to 39060 MW. Obviously, total installed thermal generation capacity in the region (39060 MW) is 30% higher than the peak load in the region (around 30000 MW). Country's share in total regional installed thermal capacity is dominantly defined by each power system size.

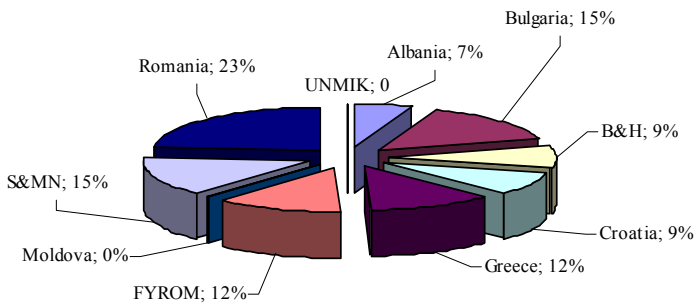


Fig. 4 Share of installed hydro generation capacities in the region

Thermal power plants in the region are dominantly based on old technologies with high generation prices. If we include constant growth of primary energy source prices (fuel, gas, coal), the role of hydro production is supposed to be even more important. Generation mix is almost equalled between hydro and thermo plants in Croatia and Bosnia and Herzegovina.

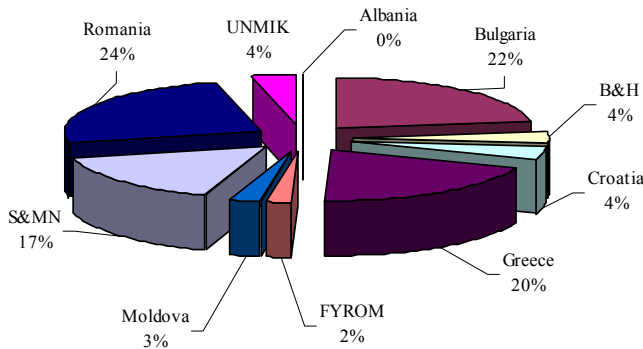


Fig. 5 Share of installed thermal generation capacities in the region

There are 2796 MW of installed nuclear capacities in the region (NPP Krško (Croatia/Slovenia, $P_{inst}=676$ MW), NPP Kozloduy (Bulgaria, initially installed $P_{inst}=2600$ MW, today $P_{inst}=1600$ MW, with possible decommissioning of 2 or even all 4 reactors till 2007), NPP Cernavoda (Romania, $P_{inst}=700$ MW, with plans for new NPP Cernavoda 2 and 3). Also in the neighbourhood there is additional 2000 MW of installed nuclear capacity in Hungary (NPP Paks). Few months ago Bulgarian government decided to start a project of new NPP Belene with installed capacity of 2000 MW.

Finally, the region is characterized by 25055 MW of installed hydro generation capacities, 39060 MW of thermal and 2796 MW of installed nuclear capacities which gives total amount of 66911 MW. It is also important to specify that annual energy productions in thermal sources are more than twice higher than energy productions in hydro sources in the region (130/55 TWh).

Few projects on regional transmission system have been realized recently [3]. The study has shown that the regional electric transmission system in 2005 fully

interconnected to UCTE, with and without Turkey and without any of the 12 proposed new interconnection candidate lines, is robust and capable of serving projected 2005 demands plus all long term contracted exchanges plus an additional 600 – 1500 MW bulk power exchange (depending on the exchange scenario). The European Council agreed on a target for the level of interconnection between Member States corresponding to 10% of installed generation capacity in each Member State in order to improve security of supply and facilitate competition. Generally, this request is satisfied in South East Europe [4]. Currently the system limitations aren't on interconnections, but in internal networks [5]. Since there were no this kind of study coordination in the past, analyzes and computational efforts have emphasized the need of further tight cooperation between experts from regional countries, especially on investigation of power transit margins. All new planned interconnection lines, observed as single elements in the network, do not increase transit margins significantly. In other words, transmission system is capable of supporting market opening in the region, while generation capacities data and new investment plans give us a basis for exchange possibilities within the region as well as between East and West.

Among technical characteristics, still there no exist clear organizational details about future regional electricity market. Till now there have been few organizational variants such as:

1. Unique regional electricity market with single, unique system operator and few national transmission companies. This option is not real in short-term period.
2. Seven, eight or nine electricity markets with the same number of system operators and lot of transmission companies, similar to existing European practice
3. Forming of import/export/transit agreement between the countries. This option does not support market development.
4. Accepting of *European Independent Electricity Market Framework – EIEMF concept*, which is similar to case 2. This model allows effective congestion management, but only in the case if it is adopted together with common power sector reform. This option is difficult to conduct.
5. Forming of single regional independent system operator (ISO) that is supposed to coordinate dispatching activities of local TSOs. This option is not real in short term period, but some kind of dispatching coordination is necessary and it is possible if all participants agree.

6. Single electricity market with lot of system operators and transmission companies. This option is realistic if we account on all power system peculiarities and specifics.

Obviously, vision of future regional market organization is not clear yet. The reason for that is in each power system occupation on its own restructuring and new organization as well as harmonization with EU rules.

8 Supply Security

Although no system can be 100% reliable, the expectations of electricity consumers are that blackout incidents are minimized as far as possible. Current trends, whereby electricity consumption continues to grow unsustainably are unacceptable and a significant effort is required to deliver energy savings. However, the expected closure of a significant proportion of existing plant also means some investment in new generation is likely in the medium term. However both demand management and generation capacity require investment and any business or household making such investments need to know that a stable regulatory framework exists as to how electricity prices will be determined. The network has to be operated at all times within acceptable frequency, voltage and current limits. Due to the physical nature of electricity and the constantly changing pattern of production and consumption, it is very difficult to predict accurately the amount of flows at any given point in the network. Control of these critical energy infrastructures is, in turn, highly dependent on the security and reliability of the monitoring and controlling interconnection infrastructures. To deal with this uncertainty, network operators adopt rules to ensure that the network has enough spare capacity so that the grid can be operated safely in a variety of extreme circumstances. This affects, for example, how much capacity between one control area and another can be safely used. In this sense there is no experience in SEE Europe, and all rules and standards in data exchange, procedure adoption as well as adequate software platforms are to be taken and adopted from EU experience. Also, expert education can significantly influence supply security on electricity market in the region. Consequently, big effort has to be done to prepare staff for completely new working environment that consists of network performance standards and balancing supply and demand. Importance of this issue is proven by European Commission.

In 2003 Proposal for a Directive Of The European Parliament And Of The Council concerning measures to safeguard security of electricity supply and infrastructure investment was published [4]. In the meantime there were many discussions on this issue but the Directive is still not accepted. Besides network operation standards and supply and demand balance, the most important aspect for supply security level is network construction. Since transmission

system is regulated monopoly new network reinforcements should be strictly and clearly defined. The network must not be limiting factor to market activities. At the same time, the consumers must not pay additional price for network overinvestment. In the middle, it is hard to predict all market needs. So, network companies should be stimulated to build new elements that are needed in the system and adequately stopped to build overestimated ones on consumer's expense. Due to utmost importance of supply security this is an opportunity for regional experts to follow the EU Directive on supply security adoption procedure and to harmonize its own laws and standards with this document in the line with EU countries.

9 Conclusion

Regional market opening actualized many questions on supply security under new conditions. Number of market subjects dramatically increased, responsibilities are decentralized and consumer requests are significantly increased. Accordingly, the main market design task comprises optimal solution of supply security problem under new conditions between subjects with contradictorily targets. Simultaneously, all power sectors in the region are going through turbulent processes of restructuring, market opening and privatization at the same time with no experience of interconnected synchronous operation in whole region. This paper presents different aspects on electricity market development and security of supply in South East Europe and its main debts.

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