

Deregulation of the Power Industry in Europe

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Abstract-- This paper will present the past, the actual and the future status of the deregulation activities in Europe. Briefly describe the deregulation process, interconnections between the different countries in Europe, the members of the European Union, speak about the United Kingdom Power Pool market, the different opportunities for some country, and at the end will be made some conclusions.

Keywords-- Deregulation, Power System, Power Market.

I. INTRODUCTION

Historically, the cost of generating power declined as utilities built ever-larger power plants, which increased efficiency and reduced production costs. Utilities routinely requested rate reductions based on declining costs and in an effort to increase electrical demand. Increased electric demand required more and larger plants, which reduced costs further as well as increasing the utility rate base. This era was a win-win for everyone. Consumers had abundant, low-cost power; regulators oversaw declining rates, increased electrification, and economic growth; and utilities and stockholders gained financially. The 1970s and 1980s saw the launching of several trends that paved the way for electric utility deregulation. The first was the energy efficiency efforts resulting from the oil price shocks. Rising fuel prices hit the transportation industry especially hard. In response, engine manufacturers designed more fuel-efficient motors. The jet turbine engine used by the airline industry is identical to that used in peaking power plants. Consequently, power plants based on these new, aero-derivative turbines had lower production costs than older designs, significantly so. Utility demand for natural gas as a generating fuel could not be satisfied at 1970 levels of production owing to peculiarities in natural gas industry regulation. Solving this problem led to the second trend, deregulation. Deregulation of the natural gas industry paved the way for electric industry deregulation both by unleashing market forces to free up natural gas for electricity generation. The deregulation of the power industry in Europe has started in 1990 with the opening of the market in England and Wales. At this time, the English power market was the first to open in Europe and it was a model for lot of countries all around the world. After that, the Scandinavian market has progressively opened in 1991 (Norway), in 1995 (Finland) and 1996 (Sweden). With the process for deregulation, private participation and competition are introduced in power

industry. The old model of power system is one of vertically integrated regulated monopoly comprising the three elements: generation, transmission and distribution. In the new model, generation, transmission and distribution are treated separately, with generation and retail services set free from the deregulation mechanism.

II. INTERCONNECTIONS IN EUROPE

Before any open market of deregulation, the electrical network in Europe was already highly developed. The reliability of the all network is improved. In case of emergency, a neighbor can provide the necessary power to allow the continuity in the delivery. Moreover, some money can be saved by reducing the number of production units or by reducing the operating cost during the peak loads. For example Switzerland (60% hydropower) needs power during the night to do pump storage, Spain needs a lot of power in summer due to air conditioning. There are 6 major groups of interconnections in Europe: UCTE, (Union for the Coordination of Transmission of Electricity). It regroups companies from Belgium, Germany, Spain, France, Greece, Italy, Slovenia, Croatia, Serbia, Macedonia, Bosnia and Herzegovina, Luxembourg, Netherlands, Austria, Portugal and Switzerland. This networks mainly goes from North to South [2]; CENTREL, four countries from Central Europe: Poland, Czech Republic, Slovakia and Hungary. They have formed this organization to be separated from the Russian network. Since 1999, they are members of the UCTE; NORDEL, regroups the Scandinavian companies, created in 1963: Denmark, Finland, Iceland, Norway, Sweden; UKTSOA, (United Kingdom Transmission System Operators Association); ATSOI, (Association of Transmission System Operators in Ireland); and UPS, (United Power System). It regroups the countries of the former Soviet Union [4]. As said before, these interconnections between countries allow an exchange of power. Moreover for companies like Electricite de France (EdF), the interconnections already allow a real trade of energy (even if this trade is desired and does not occur in a case of competition).. The figure 1 shows the different types of connection. Since 1999, the eastern countries (countries from the CENTREL, Romania, Bulgaria, countries form UPS) have tried to join the UCTE. For the time being, only the countries from the CENTREL are associated members and are connected to the UCTE. Given that the eastern countries have more problems of reliability (even if the countries of the CENTREL did a great job to join the UCTE), the exchange, at least for the time being, should be from West to East. Among the different groups (like UCTE, NORDEL), some countries have already experience the deregulation and have a full open electricity market.

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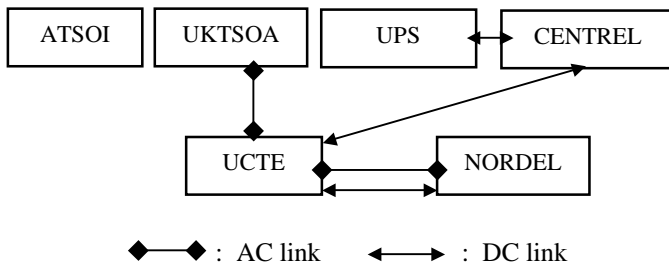


Fig. 1: Interconnection of different groups in Europe

III. THE CASE OF THE EUROPEAN UNION

Since a directive of the European Union in 1995, adopted in 1996 by the European Minister Council, the European electricity market has to open partially in 1999 (26.5%). This announces the end of state monopolies in this area. The directive foresees three different objectives:

- The opening to the competition in three steps: '99: 26,5% of each national market; '00: 30% of each national market;
- The possibility for anyone to build a power plant and to have access to the transmission and distribution networks.
- A neutral and independent electrical network.

These rules have to be applied by each country of the European Union [10]. Nevertheless, a lot of countries of the Union are behind schedule. Countries like Ireland, Belgium, France and Greece received one year of derogation.

TABLE 1. THE ELECTRICITY PRODUCERS IN THE EUROPEAN UNION. SOURCE EDF PUBLISHED IN A REPORT OF THE FRENCH SENATE [11]

Country	Producer	% of national market
Austria	Vrebund, Regional comp.	46, 31
Belgium	Electrabel (private comp.)	95
Denmark	8 producers process by dist.	
Finland	IVO, PVO, Municipal comp.	37, 23, 21
France	EdF	95
Germany	9 "biggest"	81
Greece	DEH	98
Italy	ENEL, Independent	78, 18
Ireland	ESB	-
Luxembourg	Import	98
Netherlands	4 regional producers	65
Portugal	CPPE	
United Kingdom	National Power, Power Gen, British Energy	21, 20, 17
Spain	ENDESA, Iberdrola	52, 33
Sweden	Vattenfall, Skydraft	50, 21

This delay can be due some technical difficulties or political issues. Each country has to adopt the European directives and to put them in their national laws. Moreover for a lot of countries, the electricity market is a state-owned monopoly. The table 1 shows the producers of electricity in Europe. It is obvious that for the countries that are not yet deregulated, the production is entirely dominated by the national producer (more than 90% of the production). Seeing its own market open has scared a lot of countries and they could to protect and train the national company. For example, in France, EdF (with 95% of the French market) dominates the production, and the transmission and the distribution networks

belong to it. That is why EdF will of course follow the European directive but it will follow it strictly. Nevertheless this opening will be applied to everybody, which means that it could be an opportunity for each company. One of the problem of the European directive is that it does not specify how the market has to be regulated which means, that each country can choose its own way to open its market. Some of them will follow the English model, some the Nordic one. Thus, the market will be open, but it will not have a unity.

The latest announcement from EC, on 12 March 2001 is that electricity market of its member states should be fully open to competition by January 2005. Is the member states ready? Is that will be one of the major requirements for the new members? The situation does not have to get worse before it gets better.

IV. THE HISTORY OF THE UK DEREGULATED POWER SYSTEMS AND ITS POOL

The power system of the United Kingdom (UK) and California are two typical deregulated systems that have been used. The Pool type of deregulated power systems has been used in the UK and the ISO (Independent System Operator) type of deregulated power systems has been used in the United States. The UK electricity pool suppose to be a good example of how deregulation is working. This simplified model of restructuring is also used similarly in some other countries, such as Brazil, Singapore, Australia and Argentina. It is not intended to show a detailed explanation of the UK pool, instead economical and mathematical issues are reduced to a minimum. A brief explanation of the relevant topics is presented with the intention of bringing general idea of how this pool was implemented, which is sufficient for the objectives of this paper. After the UK Electricity Act of 1989, the restructuring of the power system started. The structure of the UK electric power system after deregulation is shown in figure 2. After deregulation, the former Central Electricity Generating Board is restructured into four separate organizations: two power producers, a transmission company, and a distribution network consisting of twelve regional electricity companies (RECs). Each organization participates one the four progresses: generation, transmission, distribution and marketing. In the UK, generation is deemed an area where a competitive market could develop most successful. No specific price regulation was initially intended for generation, as the national wholesale power pool is intended to produce market based price. The UK's transmission system is a natural monopoly. The transmission is imposed periodic price reviews and price caps based on changes in the overall rate of inflation. The distribution companies are allowed to acquire generation assets with the restriction that no REC generation facilities account for more than 15 % of their individual electricity sales. This action was taken in order to introduce more competition in generation. The marketing is the last part to be deregulated. Large users are allowed to choose their marketers, as opposed to being required to purchase electricity from their REC. The small industrial and commercial companies and residential users are also under this way.

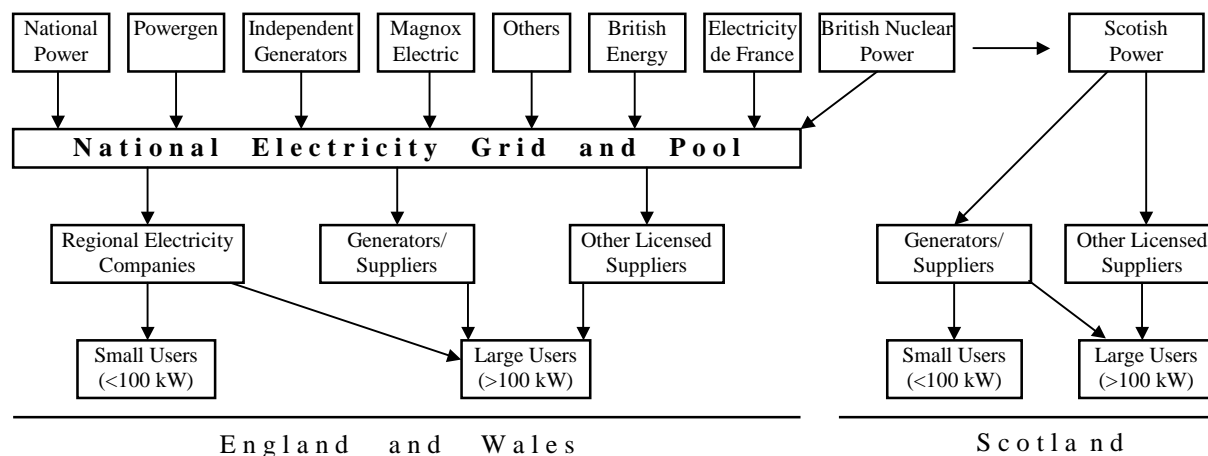


Fig. 2: Structure of UK Electric Power System

A year 1989, Stephen Littlechild, a Birmingham University professor, instituted the Power Pool bidding system that was supposed to lower prices for electricity. The Pool executive committee has ten members; three are from major generators, two are representatives of smaller generators, one is an independent retailer, and four represent twelve of the regional electricity companies. A chief executive administers the pool on a daily basis. The UK pool rules define the trading arrangements between pool members. The pool acts as a holding account for energy purchased from several sources on behalf of the customers. The UK pool rules that define the transactions between members are extensive and complexly expressed by several formulas; therefore only an abstract of some rules will be listed:

- The production is established for the next day, according to the forecast of the NGC.
- An economic dispatch, named U-schedule (U, unconstrained), based on the demand forecast is executed.
- For every half-hour "system marginal price" (SMP) is determined; which corresponds to the highest incremental cost among the generators included in U-schedule.
- Reserve capacity offered by generators is later recompensed in the process.
- The next day (planned day), NGC informs each generator about the time and level of generation needed.
- The deviation of power generated from the executed U-schedule is purchase or sold by the pool at each generator incremental cost. Unavailable generation that was offered the day before is penalized.
- At the end of the transactions, the pool-selling price (PSP) is calculated, and this is the price offered to the customers.

A forward sale is a transaction between buyers and sellers arranged one day in advance. In this type of transaction, the buyer agrees to deliver power, for periods of thirty minutes, at a certain price and time of the day, based on the U-schedules. Such a price, defines the pool purchase price (PPP), see fig. 3. Option contracts can also be set in advance. They give the holder the right to negotiate power only if it wishes. The terms of the contract include time and place of delivery, and the price, which is known as the "strike price". This type of transaction is defined as the "option fee", which is a fixed

price. It reflects the expected value to the holder of being able to negotiate power at the strike price, given that the spot market price may be higher or lower at the time of delivery. In other words, the pool pays the generators an option fee for reserve capacity. If the pool requests the next day to generate such reserves, it is paid at the strike price. Spot purchase transaction, which is characterized by immediate delivery of the product, with the price varying to equilibrate supply and demand. Many spot transactions are made to avoid previous contracts, and to remove the obligation to deliver by a compensating deal. Reasons that could make a deal to be neutralized are those such as transmission constraints, overestimated demands, lack or excess of generation in comparison to the U-schedule and emergencies. The PPP is intended to reflect the expected value of the spot market price. When the demand is lower than the generation capacity, the cost of extra supplies would be given by a spot transaction, at the highest price of any generator in the system. When the demand is higher than the generation capacity, supply and demand could be balanced only by raising the price up to a point where customers would prefer to reduce their demand. This price is known as the "value of lost load" (VOLL). The probability that the demand will exceed capacity is known as the "loss of load probability" (LOLP), and the probability of meeting load from available generation is then one minus LOLP. Then, the PPP is adjusted at die probability-weighted average of the prices in the two possible cases.

$$PPP = [(1-LOLP) \times SMP] + [LOLP \times VOLL]$$

Transactions at the customer side are simpler, NGC estimates the amount of energy they will require. The extra costs of energy above the PPP, including those from transmission constrains on the National Grid, are simply lumped together in what is known as "uplift", and divided among all the energy taken by customers. This leads to the calculation of a single consumer price, the pool selling price (PSP): $PSP = PPP + uplift$.

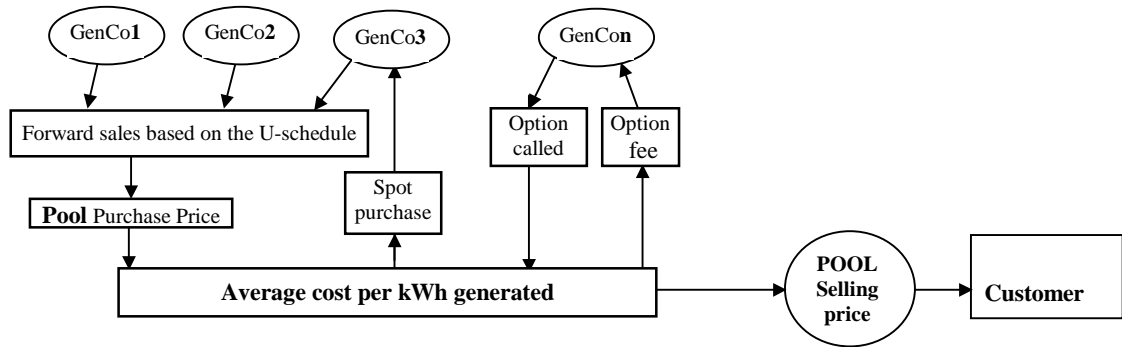


Fig. 3: United Kingdom Pool transaction under deregulation

A. Britain Power POOL, Not a Model to Follow

A couple years ago an investigation of the Power Pool market performances, lead to the conclusions that there is a strong evidence that Pool prices were being manipulated; that participants in the pool have been using rules for their commercial interests; and that higher wholesale prices have been established that will mean higher prices for customers. And this manipulation has been accelerating. Unfortunately Britain's Power Pool model was a model for restructuring around the world, including in some states in the United States. The model supposed to reduce prices for consumers. Even as the United States has moved to deregulate wholesale electricity prices and taken steps in some states toward market pricing of retail sales, some major difference between the restructured electric systems in Britain and US remains:

- In the U S, stakeholders participate fully in the process.
- Instead of being allowed to claim that cost data confidential and not to be shared, U S electric companies must provide information to the regulators and to the public that will allow "just and reasonable" rates to be determined

In Britain democratic regulation is a contradiction in terms. The high and volatile prices inherent in unfettered markets will becomes a feature of the United States electric industry as well-unless public participation and transparency of information continue to be standard practice in the pricing of electricity.

B. Transforming the Britain Power POOL

After just about a decade of high prices and market manipulations, bidding zero into the pool to ensure scheduling, and then being paid a price higher than the pool median, Britain spend an additional £100 million to eliminate the Power Pool, October 1998, and institute the New Electricity Trading Arrangements (NETA). The New NETA were expected to be activated in March 2001. The primary tenets of NETA are: forwards and futures markets, allowing contracts to be agreed upon for years ahead or day to day; balancing system administered by the National Grid Company (NGC); settlement process for recouping system operator costs.

Unlike the Power Pool model, where power was centrally dispatched (similar to California's system except that heading-buying power on the futures market to "hedge" against prices rising-was allowed), NETA allows self-dispatching, which allows the generator companies to send out power as they see

feet. But we have to remember that NETA just put in place on 27 March 2001, is too soon to know whether it will foster competition and lower consumer prices.

V. THE CASE OF THE SCANDINAVIAN COUNTRIES

In 1991, Norway started to deregulate its electricity market. That is why, in 1995, Finland did the same and has been followed by Sweden in 1996. Nowadays, the entire power market of Norway, Sweden and Finland is open. By the end of year 2002, the entire Danish market will open too. The NORDEL common market is called the Nord Pool. The goal of this opening is clearly to give advantages to the customers. Thus, they created both a physical power market (Elspot) and a financial power market (Elderion). Elspot market is the main market in which the power is really traded. This market organizes the production for the next day. The production is scheduled day by day. The auctions that place in this market are done with sealed bids, which means that the bids from the producers and the customers are first received (anonymously) and then the price is established at the equilibrium of the supply and offer (and here, the grid capacity is taken in account). People can only propose bids for their own area. The grid companies of Norway and Sweden possess the Nord Pool market, nevertheless, the Finland Grid Company is highly considered because of the capacity problems that can occur in Finland. Given that the balance can not exactly exist between production and consumption, a second power market (Elbas market for Sweden and Finland, Regulating Power Market in Norway) allows trades hour by hour this up to two hours before delivering the power. But if people do not want to use this market, they can directly have a bilateral contract with a producer. In this direction, a financial power market has also been created to allow people to buy the type of contracts they want, for the time they want (day, week, month, season) and at the supplier they want. To allow good transactions without any problems, the banks of the buyers have to certify each transaction. For this goal, another component called the Nordic Electricity Clearing (NEC) has the goal of insuring the trade [8] and [9].

VI. THE CASE OF THE RUSSIA

In reality, the Russian wholesale market is divided into several large regions due to the high cost of electricity transmission and the constraints in the Russian transmission

network: the European part of Russia, Siberia, and the Russian Far East. The structure of the economy, the power industry, and climate conditions in these regions are quite different. These circumstances cause additional problems in implementing a nation-wide model of the wholesale competitive market. Therefore, the federal wholesale electricity and capacity market in Russia will have some differences in the three large regions. In the European region of Russia, a competitive electricity and capacity market, is feasible if several generating companies are created. A new project on the electric power industry restructuring has been proposed recently by Russian Joint-Stock Company, RJSC, "UPS of Russia". The project is presently under discussion in the country. The following transformations are proposed by the project:

- All power plants are to be separated from local power utilities and transformed into new joint-stock companies. Two affiliated companies of RJSC "UPS of Russia" will be created for management of thermal and hydro power plants. Thus, electricity generation will be separated from local power utilities.
- The competition among electricity producers is supposed to increase. Market principles of pricing will be introduced into the generation business. Generation pricing will be withdrawn from state regulation.
- RJSC "UPS of Russia" for transmission network operation and development will establish an affiliated transmission company. Prices of transmission service will remain regulated.
- RJSC "UPS of Russia" will create an affiliated company for delivery of electricity to large industrial consumers. Local distribution companies affiliated with local power utilities are responsible for the electricity supply to other consumers [17].

VII. THE CASE OF THE POLAND

Currently, the pace of privatization in Poland's power sector won't change significantly, despite pressure from the government for a slowdown. The treasury will continue its policy of privatizing power generators and distributors in tandem. The Economy Ministry opposes this strategy because it fears rapid sales of power distributors will damage the prospects of generators and the unprofitable coal-mining sectors. The privatization of eight power distributors in northern Poland should be completed by Sept. 30, 2001 [16].

VIII. THE CASE OF THE GREECE

Greece's state-owned energy producer Public Power Corp. (PPC) is expected to go public in the first half of 2001, but it did not happen up to now. The government will retain the majority stake and the management of PPC. Part of PPC's preparation for entering the stock market is the rescheduling of its external debt [16].

IX. THE CASE OF THE YUGOSLAVIA

At the beginning of nineties former SFR Yugoslavia has split into five new states - Slovenia, Croatia, Bosnia and

Herzegovina, Macedonia and FR Yugoslavia (Serbia & Montenegro). Unfortunately, the dissolution of Yugoslavia was accompanied by an armed conflict in Croatia and Bosnia, and finally with NATO bombing of FR Yugoslavia. Once unique electric power system, connected to European grid - UCPT, broke into several small systems, further destroyed by war and especially by NATO, targeting the electric transmission system. Because of that, although FR Yugoslavia managed to repair its power electric system in a relatively short period of the time, instead of deregulation, process of recovering and reconstructing is on the scene. State owned Power Electric Company of Serbia is now in transition to better and more efficient organization. At this moment process of privatization and organizing a market is a plan for future.

X. THE CASE OF THE MACEDONIA

The ESM is closely following the restructuring and privatization processes all around Europe. It is already identified that the needs for restructuring of the current monopoly are necessary to improve the overall performance and cash flow of the ESM and the entire energy sector in the country. For that purpose, few renowned foreign consulting companies have already prepared several restructuring and privatization strategies for ESM. Additionally, having in mind that ESM has to operate in the common EU and Balkan Electricity Market, the restructuring of ESM must be done in the strong correlation with the EU Directives, especially Directive 96/92. A special Committee for Restructuring of ESM was established with main task to define the frameworks for future transformation and restructuring of ESM. Taking into account the size, the current structure of the sources, fuels, transmission network and the large number of the existing distribution companies, it is envisaged that the best option for restructuring of ESM is its organization as a Vertically Integrated Company with different accounts for production, transmission and distribution of the electricity. Transformation of ESM into a Holding Company with various production branches is also one of the possible solutions for improving the business effects of the company. For the privatization purposes, ESM together with the German Consulting Company CONSULECTRA developed a Master Plan, which will be used as a model document during the coming privatization. The tender for selection of the so-called Promoter or Consultant for the privatization with task to assist ESM and the Government of Macedonia through the privatization process, has already been carried out. As a first step toward privatization, ESM initiated its transformation from Public Enterprise into the Joint Stock Company with 100 % of the shares owned by the Government. Finally, as one of the necessary conditions for successful privatization of ESM, it is establishing of so-called Regulatory Commission or Agency which will be responsible for issuing electricity licenses, definition of the tariff structure for production, transmission and distribution of the electricity, and for setting all kind of disputes between parties in the fully liberalized electricity market in the Macedonia and wider. The first draft documents for establishing of the Regulatory Agency are already prepared by the American Consulting Company, Pierce & Atwood.

Having all said above in mind, one can see that ESM strongly committed itself to move in the direction of establishing a new market oriented power company which will be strong partner to the neighboring power companies in near future. With the help and support from the Government, it is estimated that the Macedonian energy market will be 30 % liberalized by 2003, and fully liberalized by 2006, for which Macedonia already signed a Protocol with all neighboring countries on September 1999, in Thessalonica, Greece.

XI. THE CASE OF THE BULGARIA

Bulgaria's energy sector is not yet strong enough to face competition from foreign suppliers and will remain closed at least for the time being to allow domestic players to get used to the liberalization market conditions. In a statement, the government said it would allow some local power and gas consumers to sign delivery contracts and negotiate prices with local producers as a first step towards a long-delayed privatization process. An official from the state Energy Regulation Commission told the Reuters news agency, "We do not plan to allow domestic power and gas consumers to sign contracts with foreign producers. Our market is still very weak and will remain closed for foreigners for now." Bulgaria is seeking to join the European Union but has faced criticism from the Commission and the International Monetary fund over the slow pace of reform in the energy sector. In 1998, the Bulgarian parliament began to liberalize the country's power sector by unbundling the generation, transmission, and distribution activities of the national electricity company, NEK. In the summer of 2000, the largest power plants and distribution networks, including the country's Kozloduy nuclear power plant, were separated from NEK, creating seven generation and seven distribution companies. Six of the seven independent power generators registered a profit in 2000, and some of them (but not Kozloduy) will be eligible for privatization. The government plans to sell its seven power distributors by the year-end. Bulgaria's electricity is mostly coal fired with nuclear and hydropower also contributing to the surplus which gives the country the surplus to export within the region. The power sector is in need of investment though, as much of the plant is scheduled for retirement by 2010.

XIV. CONCLUSIONS

Nevertheless the deregulation is something new in the area of the power, and nobody knows exactly if it is really an opportunity for the customer. The first years in England were a nightmare with a lot of peak of prices. Theory is bumping up against reality, as in California. In Brazil for example prices following privatization shot up 400%. 40% of electricity workers lost their job, and the lights went out. The deregulation in the North seems to happen very well without any major issues. The recent opening in Germany seems to be very well too. That is why nobody can predict if it will be so good or not for European customers, especially for the countries under development like, Balkan countries. Nevertheless it is a good opportunity for companies to expand themselves and win some parts of the other national markets. It

is a good opportunity to for the Union to look at the East and to expand itself.

One of the key changes brought on by electricity deregulation in the Europe, has been a market increase in energy asset transfers. In 1999, nearly US\$10 billion worth of generation assets were transacted. In addition, more than 200 GW of new capacity is under development. Almost 70,000 MW of new capacity may be added in Europe by 2005.

Different power systems have different process of deregulation and encounter different problems. Solving these problems will improve power quality and reliability and further maximize the benefit of both power providers and their customers. Many experiences from different deregulated power systems show the great advantage in the development of power system.

In the real world, power markets are too easy to monopolize and manipulate-that is, to game-for the theory to hold.

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