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ELECTRICITY SECURITY OF SUPPLY CHALLENGES IN THE ENERGY COMMUNITY

Purpose

The purpose of this paper is two fold. On one hand the paper outlines the legal provisions which each Party has in place in case of shortages and on the other hand it tries to identify potential Security of Supply challenges, when possible for the winter of 2006/2007.

The short time available for preparing this paper has not allowed the Energy Community Secretariat to obtain system adequacy studies from the Parties or TSOs. It therefore provides a general overview of the potential challenges based on the know-how of the Secretariat staff.

Legal Provisions

The importance of security of electricity supply should be put in the context of a liberalised market and citizens' expectations. The role of the TSOs in securing electricity supplies becomes more important as they are expected not only to coordinate among themselves, but also to facilitate the harmonization of interests of various stakeholders: policy makers, power generators, traders, consumers and regulators. Operation of the electricity infrastructure is a complex task subject to, among others, Electricity Laws and Transmission Grid Codes. Operationally, the challenges that TSOs are facing in meeting the requirements of an increasingly liberalised and competitive market in the South East Europe have no less importance than the emerging issues of generation adequacy across the region in relation to transmission network capability. Infrastructural development of new transmission interconnections may contribute to security of supply only if there are market based incentives for generators to invest in new generation capacities, provided that there is a demand side's contribution in the form of a proper response.

In Albania, the Transmission Grid Code has a specific chapter on planning and operation of the system. Operational aspects are responsibility of the system operator, OST, which established everyday the network configuration, monitors the outage time in the transmission network, and plans the network development according to the (n-1) static security criterion.

In Bosnia and Herzegovina, the operational aspects of monitoring of security of supply are responsibility of the Independent System Operator which is obliged to inform about the current status of the security of supply, although the Grid Code is still to be approved.

Bulgaria, in its transmission grid code has defined rules for forecasting shortages of electricity for the following year. The procedure involves the interaction between the System Operator, the Generation Units and the public provider. The Grid Code also calls for issuing a Defense Plan in accordance to the UCTE rules with the aim to protect and prevent against general system failures.

Croatia has addressed the Security of Electricity Supply in the Electricity Market Law and in the Transmission Grid Code.

FYROM has adopted the provisions on Security of Supply through the Energy Law and the Transmission Grid Code.

In Montenegro, the Energy Law provides the general framework for Security of Supply. The adopted Provisional Transmission Grid Code contains the specific provisions on planning and operation of the system.

Romania has the specific provisions regarding planning and operation of the system in the Transmission Grid Code while the general framework is given in the Energy Act.

In Serbia, the 2004 Energy Law calls for the development of detailed procedures regarding Security of Supply, including prevention and management of electricity shortages. The Transmission Grid Code Final Draft has been submitted to the regulator for approval and it is expected to enter into force in the second half of 2006.

In Turkey, the Electricity Market Grid Regulation contains the key provisions related to planning and operation of the system. The TSO is obliged to prepare a 10 year capacity generation forecast covering ten years. As for the operation the TSO must define the adequate generation capacity and to establish the standby reserve and the operating reserve.

UNMIK addresses the provisions on Security of Supply in the Electricity Law. However it has not been adopted detailed procedures regarding the operation of the system.

General electricity balance overview in the South East Europe

As the iECS does not have at its disposal a structure set up specifically for monitoring of security of supply in the South East Europe, a recognition of future challenges is here based on the trends from 2005 that can be noticed from a very informal overview of the electricity generation/demand balance and transmission capabilities in the region. Figures given hereafter shall be taken just as being indicative.

Consumption. In 2005 electricity consumption increased in all countries in the South East Europe comparing to 2004. The lowest increase is achieved in Bulgaria (2%), while the highest was in FYROM (7.8%). The annual average load growth equals to 1.3% in the main UCTE block. Regional electricity consumption increase amounted 3.4% on average. Low consumption season usually starts in April and lasts till October. The situation is actually opposite only in Greece due to higher load demand during tourist season. Approximate values of electricity consumption are as follows: Greece 53TWh/year (between 4TWh/month and 5.3TWh/month), Romania 52TWh/year (between 3.9TWh/month and 5.2TWh/month), Serbia and Montenegro 41TWh/year (between 2.7TWh/month and 4.4TWh/month), Bulgaria 36TWh/year (between 2.5TWh/month and 3.6TWh/month), Croatia 17TWh/year (between 1.2TWh/month and 1.7TWh/month), Bosnia and Herzegovina 11TWh/year (between 0.8TWh/month and 1.1TWh/month), and FYROM 8TWh/year (between 0.45TWh/month and 0.9TWh/month).

Generation. Regarding annual electricity generation, approximately the same portions of electricity is generated in thermal and hydro power plants in Bosnia and Herzegovina (6TWh each) and Croatia (6TWh each). Thermal power plants generate roughly twice more electricity than hydro power plants in Serbia (26TWh and 14TWh) and FYROM (5TWh and 2TWh), whereas it is opposite in Montenegro (1TWh and 2TWh). Thermal and nuclear power plants generate similar amount of electricity in Bulgaria with a smaller contribution from hydro (20TWh, 18TWh, and 5TWh), whereas thermal and hydro power plants do so in

Romania with a smaller contribution from nuclear (30TWh, 20TWh and 5TWh). In Albania, electricity is generated almost exclusively in hydro power plants (98%). Hydrologically dry season usually starts in June and lasts till October and even November. If it is prolonged even further, then countries with exclusively hydro generation such as Albania face serious shortages of generation.

Export/Import. In the South East Europe regular importers are Croatia 5TWh/year (30% of yearly consumption), Greece 4TWh/year (7.5% of yearly consumption), Serbia and Montenegro 2TWh (4.5% of yearly consumption), and FYROM 1.8TWh/year (22.5% of yearly consumption). Total electricity demand in Montenegro equals 4.5TWh/year, whereas planned yearly generation is 3TWh/year. The rest (1.5TWh/year or 33% of yearly consumption) is imported in Montenegro. Romania was importer in March only (2.5TWh/year of export in total). Only Bulgaria was exporter on the monthly basis through all year 2005 (7.5TWh/year of export in total). Bosnia and Herzegovina was an exporter on a yearly basis (1.2TWh/year). Import of electricity in FYROM increased 8 times in the period between 2000 (imported 4.4% of total consumption) and 2005 (imported 33% of total consumption). In Croatia, it is economically more favourable to import electricity than to generate it in its own thermal power plants. Maximum import appears in winter season in all countries, except in Greece where it happens in summer season.

UCTE: Closest existing reference on security of electricity supply

In December 2005, the UCTE issued the ‘System Adequacy Forecast 2006-2015’ setting out a power balance forecast for the interconnected European power system. It contains remarks on security of electricity supply in the South East Europe (although the South East Europe is there segmented into three different blocks: Romania+Bulgaria, JIEL+Greece, and the main UCTE block):

- In the Romania+Bulgaria block, generation capacity is decreasing slowly from 2006 to 2010 but adequacy is achieved for this period. Additional investments up to 2 GW are needed to meet the adequacy reference margin. It means that the generation adequacy will be maintained at a satisfactory level in Romania and Bulgaria over the period 2005 – 2010. Imports from the CENTREL, which should remain a structural exporter in the short term, can provide additional capacity.
- In the JIEL+Greece block, the remaining capacity of the block is low and reliability is not ensured. The margin remains below the reference adequacy level and imports will play an important role to ensure security of supply. The situation for this block is much tightened since 2006: the margins are 3 GW below the adequacy reference margin for summer load. Serbia and Montenegro, FYROM and Greece stay in a weak position concerning generation adequacy and the situation will be worsened if investments are not realised.
- In the main UCTE block (where Croatia and Bosnia and Herzegovina belong), the adequacy reference margin is respected all over the period 2006-2010. But in a conservative scenario, there will be a lack of 11 GW to fulfil the indicative adequacy feature in 2015. This block, globally exporter now, is expected to have a decrease in its export potential, and could show a need for import in 2015.
- Cross border flows inside the South East Europe and with the Central Europe that already improved in 2004 thanks to the reconnection of the two UCTE zones will be of utmost importance for the reliability of the region. If the generation investments foreseen are not realised, major parts of South East Europe will be in a weak position concerning generation adequacy. Currently, import from Romania+Bulgaria block, both of which have an existing export capability, help to balance the situation.

In order to have a better understanding of actual monitoring of security of supply in the Energy Community in the short, medium and long term it is proposed to discuss a possible cooperation with UCTE.

Case study: Albania

Albania has not built a new generation power plant since 1986. It has been facing a major electricity crisis since the summer of 2000 due to huge demand for electricity which is domestically 98% generated in the hydro power plants. Since it relies almost exclusively on the fluctuating electricity generation from the hydro power plants, it makes it extremely difficult to achieve an internal generation/load balance due to a low percentage of thermal power plants. The limited capacity of the hydro power plants and the lack of adequate interconnection lines make it impossible for Albania to meet its growing electricity needs. Consumption and demand have steadily increased. In 2005, residential consumption of electricity rose by 8% from the previous year. Since 1991, household consumption levels have risen by 500%, while Albanian capacity to generate energy decreased by 14%.

Currently, Albania has a total installed generation capacity of 1684 MW and can produce around 5.5TWh/year in hydrologically favourable conditions. Its high voltage transmission system is interconnected by one 400 kV line to Greece (500 MW capacity), one 220 kV line to Montenegro (200 MW of capacity) and one 220 kV line to UNMIK (200 MW of capacity). However, indicative value of the net transfer capacity for the summer 2006 season from the JIEL+Greece block to Albania equals only 200-250 MW (from Greece to Albania it is 0 MW). Inadequate transmission interconnection and a lack of modern dispatch centre makes electricity import a very difficult task. Moreover, the recently established and properly unbundled Albanian transmission system operator (OST) is still not a member of the UCTE.

Domestic production satisfied 97% of domestic demand in 1990, but only 47% today. The rest of energy has to be imported from neighbouring countries, if they do not experience difficulties in electricity supply of their own. Albania considers electricity imports in a bid to alleviate the affliction, but this is too expensive a solution for this economically weak country (GDP per capita ≈1250€). Recently, invitation to bid was announced in the FT according to international competitive bidding procedure for purchasing of 1.436TWh of electricity for €49.5 mil during 9-month period April 1, 2006 – December 31, 2006. The average price for electricity delivered equals 34.5 €/MWh. The period has been actually divided into three parts with different average prices (spring 31€/MWh; summer 33.4€/MWh; autumn 37.6€/MWh). The average residential electricity price equals approximately 50€/MWh, and if 40% of this amount is related to generation it makes price of domestic production around 20€/MWh. It means that the electricity is imported at significantly higher price, of course if there is any at all and at the price range given. Last year's bid for 780GWh of electricity for €27 mil (average electricity price 34€/MWh) failed in an unsuccessful auction. The equalising fund has been established that compensates for a price difference between electricity generated in the domestic market (lower value) and imported one (higher value).

The situation in Albania changed dramatically through the year 2005. Electricity target for 2005 was set by estimating that total demand would equal 6.64TWh/year, while the total domestic generation would be 4.05TWh/year. The import was planned to be 2.25TWh/year and load shedding 0.34TWh. In 2005, the maximum peak demand was equal to 1254 MW, and the total generation capacity was 1364 MW. According to the UCTE definition, the percentage of reserve was equal to 13% in January, and 57% in July. In the first 6 months Albania had its export-import balances around zero, but due to serious droughts its imports were constantly increasing starting from July. Due to insufficient transmission network capacities and insufficient offered energy in the region in these months, serious load shedding was introduced in the last quarter of 2005 (approximate amount of 20% in October and November). That crisis decreased Albania's annual economic growth rate from 6% to 5.5% in two months alone. Solidarity in the crisis was expressed by neighbouring FYROM, which 1) transferred some of the electricity it imports from Greece to Albania, and 2) released more water from the Lake Ohrid into the Black Drin River in Albania to boost hydro generation in Albania.

The changes to this situation can not come soon enough, most probably by 2008, if at all. It will take at least two years before it would be possible to generate the needed amount of electricity through a series of infrastructural reinforcements. Till then, only a few measures could be envisaged: 1) conservation of water levels in reservoirs and 2) careful planning to secure imports could help alleviate consequences of serious droughts. Among infrastructural projects, the most important ones are the following:

- Building TPP Vlora with a generation capacity of 1TWh/year;
- Building new 400 kV Tirana substation;
- Building 400 kV OHL Elbasan – Tirana – Podgorica (connection to Montenegro);
- Building 400 kV OHL Vau i Dejes – Prishtine (connection of Albanian hydro generation portfolio with the UNMIK's thermal one and thereby opposite power exchanges in winter/summer seasons);
- New National Dispatching Centre in Tirana; and
- Promotion of more feasible energy sources (i.e. gas) for heating purposes.

Case study: Bulgaria (NPP Kozloduy)

Originally, the NPP Kozloduy contained 6 pressurized water reactors with 6 generating units which had total output of 3760 MW. The VVER-440 Model V230 (440 MW) is used for the Units 1-4, and the VVER-1000 (1000 MW) for the Units 5-6. The Units had been put in the operation in 1974 (Unit 1), 1975 (Unit 2), 1981 (Unit 3), 1982 (Unit 4), 1988 (Unit 5), and 1993 (Unit 6). The VVER-440 Model 230 has been considered as dangerous. Under a 1993 agreement between the European Commission and the Bulgarian government, the Units 1-2 were taken off-line at the end of 2002. The Units 3-4 are scheduled to be taken off-line at the end of 2006, immediately before the planned date for Bulgaria's accession to the European Union.

The NPP Kozloduy covers 44% of Bulgaria's electricity demand and allows the country to export about 1/5 of its electricity abroad. With the Units 1 and 2 taken off-line, Bulgaria currently exports about 14% of its electricity. However, Bulgaria has warned it may completely stop electricity exports in 2007, when the Units 3 and 4 are asked to be taken off-line. Yearly export of Bulgaria amounts to approximately 6-8TWh/year. The Units 3 and 4 have nominal power of 440 MW each (880 MW combined). Rough approximation results with about 7TWh/year of a base load electricity that these two units generate during the year (880MW x 8000 h/year, accommodating for 33 days of regular maintenance). It means that by taking these two units off-line, Bulgaria would satisfy its own demand, but could hardly export or the export will be much less.

It is estimated that Bulgaria's export of 7TWh/year would cover approximately 50% of the electricity shortage in the neighbouring countries (Serbia and Montenegro, FYROM, Albania, Greece). Having this amount of electricity taken off-line, these countries should ask for another generating source, which would probably lead to additional increase of electricity price in the South East Europe. According to recently published work of the World Bank, increase in electricity prices could seriously affect these countries with lack of power production facilities. The largest price increases are expected in FYROM, Albania, Bulgaria and Serbia.

Bulgaria has clearly stated that it will strictly follow its obligations, related to the closure of units Units 3-4 before the end of 2006 in accordance with its commitments under the Treaty for accession to the EU, which has been ratified by the Bulgarian parliament in 2005.

In parallel, the construction works on the Unit 2 in the NPP Cernavoda (Romania) are most likely to be delayed for at least a year. The NPP Cernavoda is designed to have 5 CANDU Units of 700 MW each. Currently, only the Unit 1 is operational providing 10% of Romanian electricity consumption. After the Unit 2 becomes operational, the NPP Cernavoda will have provided 18% of power consumption in Romania. The first operational tests of the Unit 2 should have started in December 2006, and the Unit 2 was scheduled to be operational in the beginning of March 2007.

Conclusions

The legal basis regarding prevention and management of shortages of electricity vary from country to country. Most of them have adopted Transmission Grid Codes, which include the issues regarding planning and operation of the system. What remains unclear, is up to which extend TSOs have actually in place operational procedures regarding the operation of the system, prevention of shortages and the operation of the system when a shortage occur.

The 'System Adequacy Forecast 2006-2015' prepared by UCTE highlights that reliability in the JIEL+Greece block is not ensured, calling for investments to improve the generation adequacy. Romania and Bulgaria are expected to maintain a satisfactory generation adequacy level, although it might decrease during period. This situation will change when Units 3 and 4 of the NPP Kozloduy are shut down in 2006 as agreed with the European Union. In this case Bulgaria will still cover its national demand but would be exporting much less – if at all - compared to the current almost 20% of its production.

Albania's shortages in recent years are due to the severe draughts (98% of the electricity comes from hydro), the lack of transmission capacity and the difficulties to find import suppliers. The changes to this situation can not come soon enough, most probably by 2008, if at all. It will take at least two years before it would be possible to generate the needed amount of electricity through a series of infrastructural reinforcements. Until then it is required a good management of the water reservoirs and to ensure imports of electricity.