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MASTERING INTERCONNECTED GRIDS

Especially during December 2001 and January 2002, a critical situation for the operation of the UCTE system has been observed by TSOs within some countries. This situation was basically caused by the price levels in the European energy markets and, at the same time, limited availability of primary energy sources that follow seasonal changes. As a result, the transmission system was operated with unusual load-flow patterns, close to the physical limit, and without sufficient security margins. In order to cope with these events, it was already necessary to apply ad-hoc measures like limitations for power exchanges and interruptions of supply. Such situations are likely to occur again in the near future due to the further promotion and increased use of short-term energy markets.

Congestions in Germany and Switzerland

Since the beginning of a cold period in the middle of November 2001, large and unusual physical power flows have been observed in the South-German and in the Swiss transmission systems. The combination of low temperatures, low hydraulic production and high electricity prices on the spot market had a strong influence on the electricity exchange situation in this area. Extreme power flows occurred from north-east to south-west inside the German EnBW-Grid, so that some transmission lines were operated close to their capacity limits.

The reason was a delivery schedule of more than 3,800MW from Germany to Switzerland. There had been a congestion in the 220kV system because a German nuclear power plant of an installed capacity of 1,400MW was out of operation at that time. The situation became even worse after mid-December as the weather got significantly colder and prices in European energy markets rose extremely. In the night hours of December 20, a delivery schedule of nearly 5,000MW was registered between Germany and Switzerland.

During these hours, more than 10 transmission lines in the EnBW system reached between 90% and 100% of their maximum capacity in the base-case. The network-analysis-function that controls the (n-1)-security criterion detected that in case of a failure of some grid elements a number of transmission lines would reach 145% of their maximum capacity. In parallel, a very high load appeared on the Swiss 380kV transmission system and on the transformers to lower voltage levels. In order to guarantee (n-1)-security, it was necessary to start additional rotating production reserve in Switzerland and, for the first time, to limit electricity imports from Germany. <<<

New exchange patterns in France and Spain

In December 2001, consumption in France reached a historical maximum level of 77,080 MW, the last record amounting to 72,450 MW in January 2000. This increase was significantly higher than the average growth rate of energy consumption in France. Due to this peak demand, the exchange pattern changed very rapidly: on December 6, the French system hit a record value for the export balance with a maximum hourly value of 12,450 MW. Two weeks later, the net balance showed an import

surplus of approximately 2,000 MW. Such enormous fluctuations show the reactivity of international exchanges to the volatility of market prices. This change in the exchange patterns has had particularly important impacts on the physical flows between France and Germany. Exports from Spain to France have been observed, whereas usual flows are going from France to Spain.

On December 17, 2001, values of 707 GWh, 34,930 MW and 35,500 MW for daily energy demand, mean hourly power and peak power, respectively, were recorded in Spain. On this date, the high electricity consumption, which was expected to reach 36,300 MW during the peak period, gave rise to a number of special steps that had to be taken to reduce consumption. These steps included an interruption of supply, where allowed in the contracts, and the request to moderate electricity demand during critical hours. In view of the seriousness of the situation in two specific areas of the system, the TSOs requested temporary load shedding of some 500 MW. <<<

New perspectives for the future

1st Synchronous
UCTE region

2nd Synchronous
UCTE region

Synchronous operation
with 1st UCTE region

Synchronous operation
with 2nd UCTE region

Following the above observations, it can be concluded that:

- changes in the availability of primary energies, incidents of generating units as well as seasonal and occasional influences may cause significant deviations of the prices in the European energy markets,
- the volatility of power exchanges and physical power flows has increased significantly (even in time frames of a few hours) due to market mechanisms,
- the resulting physical power flows tend to approach the security limits for the operation of the transmission systems, and to complicate and impede operational planning based on history,
- in addition to current congestion, new cross-border congestions as well as internal congestions are expected to emerge if this type of situation will continue to occur in the future,
- additional measures of the TSOs will be necessary to secure the operation of the UCTE transmission system under these circumstances, in correspondence with the current procedures for congestion management.
- development of network infrastructure with a view to facilitating increasing electricity transactions in the integrated market. <<<