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Reliability of the electrical energy supply

Reliability of the electrical energy supply (RES) is a complex problem as in Europe as in Hungary. To the RES are impacts from the countries UPCE too. In last years the new demands generated by the high environment- demands and the market liberalizations.

In the next future the RES of Hungary to decrease the reliability we will meet the next tasks:

- Safety of the fuel supply (proportion of the fossil fuels , nuclear fuels and renewable sources)
- attainment of the control the export-import transportation between the „parallel possibilities” (on the international 220-500 kV networks)
- The right selection of the fuel-proportion in the national energy-systems
- To develop a long-term plan for the building of the new electrical plants and to find the optimal investor conditions
- To develop the National and International Transmission Systems (220-400 kV)
- To install new regional system-automations.
- To solve new ways in the MV-LV distribution networks (grounding, regime , telemechanics , relay protections)
- Harmonization load management (ripple control systems) and smart metering.

The following tasks to be completed:

1. The energy trade as well as the spreading deregulation of the energy markets are responsible for the increased risk in energy supply. The deregulation enables the free trade of electricity in large geographical territories but does not take into consideration the restrictions of the Transmission Systems. The different members of the cooperating systems are operating a so called Area control Error princip, which enables the maintenance of the export-import balance as well as the compensation of the differences in the frequency. Since there is no instrument to the influence of Load Flow, overloads can occur anywhere, which can cause blackouts for entire regions or even countries, leaving these territories without electricity supply. This operational failures of the international electricity lines are especially dangerous for the importing member countries. The largest proportionate electricity importers within the UCTE are Luxembourg, the Netherlands, Italy and Hungary. Consequently, the danger of blackouts are the highest in these countries.
2. Special attention should be drawn to the energy flows over a certain limits caused by the liberalisation of the markets. Other words there should not be deals over 300-600 MW without the approval of the system operators
Today the majority of the international electricity flow happens at a level of 400 kV, where the individual transmission capacity is limited to 1200-1500MW. In case of these transmission the approximately 500MW additional capacity can easily cause blackouts (due to overloads).
3. There is a need to consider the possibility of creation of regulated transmission systems ("electricity auto-bahn").

These would mean 1500-2500 MW capacity, well-located DC couplings transmission systems. The most urgent task is to regulate the north-south electricity flows, since the highest volume transmissions are in this direction. What makes the current situation more critical is that Austria does not have 400 kV transmission capability in the North-South direction, therefore most of these electricity transmissions are burdening the Swiss and the Hungarian electricity systems.

4. The 110 kV network usually represents (n-1) security level. Consequently, it is a real danger lose a 110 kV district with a consumption of about 15-30MW.
The urban 10 and the 20 kV networks in the country are also based on (n-1) security levels and are operated in a radial-topology.
In an urban string-type (by ring main units) electricity system double cable failure in the 10 kV network or even in the 0.4 kV network can cause a 2 day blackout (this the time of fixing the cable problem). In Budapest fixing even a simple failure is a matter of the traffic situation.
What makes the situation even worse is that the 10 kV distribution network does not have decentralised automatic and interruption devices, like the well-operating pole-reclosers (TMOK) in case of the 20kV network.
It should be further investigated whether the currently used radius operation mode in the 0.4 and 10-20 kV networks can be sustained. In the age of wired and wireless information and command transmission the small and medium voltage networks can be operated in bundled (hurkolt) operating mode. This would significantly increase supply security and would decrease network losses.
5. There are new possibilities in the load management and in the metering technics. In last years the ripple controls systems (183.3 -216.6...Hz) are changed for the long way radio-controlled systems. The radio systems has regional features (covered some countries) and the command-time is decreased up to 1-3 secundum. In parallel in some countries there are big investments into the smart metering (Italy 30 million costumers , in France planned for 35 million residual costumers and Sweden is covered too by smart metering).

In summary the following can be concluded:

- The original task of the European interconnected transmission networks was to ensure the secured electricity supply in continental Europe.

For this reason the system was developed in the last 50 years in a way that the national subsystems can mutually help each other. In the recent years the circumstances have significantly changed.

Today the European interconnected transmission networks are not only the tool of providing temporary help to the national subsystems, but has become the platform of the increasing cross-european trade of electricity supply. The liberalised market has lead to larger cross-border trades. The increasingly widespread usage of wind electric

plants can cause unexpectedly high geographical and timing fluctuations in electricity flows.

When developing the system, these fluctuations were not at all considered.

- There are more restrictive limitations in development of the transmission systems due to environmental reasons. For this reason the transmission system operators – TSO-s – are operating the transmission systems more and more closer to their security criteria, and these criteria are based on the physics of the system.
- It would be essential within the EU to establish an efficient body – a Council – which would be responsible for the development of the European electricity network. There would be further a need for the establishment of a common European fund to finance the fixing of the problems of the whole European transmission system.
- At the electricity distributors the financial and economic approach has become widespread which in a lot of cases means less emphasis on the professional (technical) work. The more commonly repeated phrase: **“there is no person who cannot be substituted”** not always can be applied in the electricity supply, where only the several year experience and local knowledge ensures the adequate and secured operation and supply. Currently only the State Regulator can enforce the adequate level of supply from the utilities. The criteria the utilities have to meet are fairly loose, therefore there is no significant pressure on the decision makers of the utilities for development of the distribution network.
- **The outsourcing**, which is deemed economically rational, can lead to the deterioration of the quality of services. The minimum level of activity and tasks which need to be kept within the electric utility, should be determined and regulated. The currently introduced unbounding in several cases

can lead to such anomalies which can significantly deteriorate the security of supply.

In summary, the security of the electricity distribution system is a complex issue, which cannot be solved on a unilateral basis only by the State Regulator, by the TSO-s or by the utilities. All parties need to find their own task and find their mistakes, which currently lead the development of the electric utility industry not in the right direction [4], [5].

The different EU directives do influence the directions of the electric supply system (renewing energy resources, program on energy savings, etc), but an overall “white book” as guidance is missing the TSO-s, the regulators and the utilities.

In addition, I do feel extremely important that the professionals of the electricity system do consider a true career opportunity their job in the system. The continuous restructuring can provide temporary results, but can continuously deteriorate the job atmosphere for the professionals working in the sector.

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