Oil Shale, 2013, Vol. 30, No. 2S, pp. 193–194
doi: 10.3176/oil.2013.2S.01
ISSN 0208-189X


# EDITOR'S PAGE

## OPTIMIZATION OF POWER SYSTEM OPERATION

The basic function of the power system is to supply its customers with electrical and thermal energy at the competitive unit price as economically as possible. Power systems must be possibly sustainable, secure and safe for the environment.

Thermal power plants are one of the main producers of electricity. More than two thirds of the electric energy produced in the world is generated by power plants using fossil fuels. If we also include nuclear power plants in the list of thermal power plants, then over 80% of the world's electricity is accounted for by the latter.

In Estonian power system thermal power plants are producing more than 90% of electric energy. These plants in Estonia are oil shale-run thermal condensing type power units with fairly weak manoeuvrability. There is only 5 MW of power installed in small hydro power plants and all of those are run-through type with no water reservoirs. At the same time, the installed capacity of wind power reached ca 270 MW. Estonia's total installed power is about 2360 MW and the peak power demand approximately 1500 MW.

Operation and development of power systems must be optimized. This enables one to minimize the fuel cost, cost of operation, expected investments and environmental impacts. The problem of optimal planning of generating units arises from an optimal operation of the power system as well as from the planning of new power units or new oil shale minings expanding power system. This is one of the most important optimization problems in power systems. The optimal planning of generating power units associated with power plants problems involves two important optimization subproblems: optimization of load dispatching and optimization of unit commitment.

Nowadays the theory and mathematical methods for optimization of power systems enable us to take into account different types of constraints and to consider not only the deterministic information, but also the probabilistic, uncertain or fuzzy information.

The power system with thermal power plants has some operation problems with large wind parks. Wind power generation makes the active

power balance regulation more complicated and expensive. If there are large wind parks connected to the power system, traditional power regulating plants must regulate generation in a wide range and with considerable speed. Also large amounts of regulating reserves are needed as hydro pump or gas turbine plants.

Most of the oil shale fired thermal units have a minimum operating power of approximately 50% of nominal. In Estonia, the daily load variation is usually 40% of daily peak load demand changes leaving only 10–15% available for fast power reserve for sudden load changes, generation outages and wind power variation. Consequently, if more wind power will be installed to the power system than 10–15% of daily peak load, then the control of the power system balance will become difficult even considering only the slow changes in demand and wind power.

Besides the regulating ranges also the ramping speeds of thermal power plants must be considered. According to the operational instructions of ordinary oil shale power plants, the nominal gross power up-ramping rate for an oil shale fired power unit is 2.5 MW/min. As the wind power capacity may change very quickly, it can be noted that the lack of the ramping speed of thermal power plants would become the primary limiting factor for wind power integration.

All these problems will be very important when power plants operate in open market conditions.

This special issue of Oil Shale has been mainly compiled by the researchers of the departments of Electrical Power Engineering, Thermal Engineering and Mining of Tallinn University of Technology, but also the researchers from other universities and organisations have contributed to it.

I hope that in this issue of Oil Shale the reader can find a lot of useful and new information about energy supply problems in Estonia, power networks and power system reliability, about oil shale mining and oil shale gasification.

Professor *Heiki TAMMOJA*
Department of Electrical Power Engineering
Tallinn University of Technology