MULTIPLE OBJECTIVE APPROACH TO GENERATION SCHEDULING OF A HYDRO THERMAL POWER SYSTEM

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SYNOPSIS

Generation scheduling of Hydro Thermal units of a power system are dependent on many factors. The important ones being availability of resources and the system demands. The Electricity demands chiefly comprise of voltage (KV), Current (I), Frequency (Hz) and Time of the day (Hr). For the purpose of scheduling, the demand is aggregated and taken as Power (MVA), Power factor (pf) and Energy (Kwhr). Frequency being under statutory control is taken as fixed.

Most of the studies reported have tried to evolve methodologies and approaches to solve problems of power system which operate a surplus grid. However, in India, most of the States operate a deficit grid system for major part of the year. With an aim to explore the possibility of evolving approaches for generation scheduling in a deficit situation, it was found appropriate to use a multiple objective approach.

The one objective which influences the generation scheduling exercise in a deficit situation is the minimisation of Electricity Supply deficit. This, when translated into mathematical equations, would be one of nonlinear relationship. When attempting to model a large power grid such as Andhra Pradesh, it would necessarily involve a large number of variables. Commercially, computer softwear packages are not available which will solve nonlinear relationship of a large number of variables in a short time. Thus it was found necessary to simplify the model for utilising the popularly available computer packages for the scheduling exercise.

For this purpose, three objectives namely Minimising Deficit Power supplied, Minimising the Deficit Energy supplied, Maximising the Efficiency of hydro power generation were identified. The constraining equation in the optimising packages were linearised to effect quick realisation of solutions.

The model was used for scheduling various hydro station units of Andhra Pradesh grid system for two days. Seven alternative schedules were obtained of which four schedules were found to be non-inferior. When compared with the actual operation of the various units of the grid system, it was found that the computer schedules additionally provided nearly 6.2 lakh units of energy over the two day period.

Though the four non-inferior schedules were different, the objective function values were found to be the same. Hence the difficulty in choosing a particular schedule for implementation. For this purpose, the criteria for the choice of a schedule were enlarged to consider transmission losses, maximum value of the power deficit and average hourly power deficit. These also did not very clearly indicate the superiority of any one schedule over the others.

Evaluation of the schedules with such other factors as Spinning reserve, revenue realised by the Power Board, utilisation of captive power generation were also attempted. These also did not clearly indicate the superiority of the schedules. Also difficulty arose in prioritising and weighting the various above factors.

With a view to obtain better insight into the influence of the above factors, an opinion survey was conducted amongst the practising engineers who were/are associated with the grid operation. The analysis of the survey indicated that the practising engineers themselves differed widely as to the influence and range of influence the factors will have on the scheduling exercise. The opinion survey was used in developing coefficient of preference (CoP) which was used for evaluating the noninferior solution set obtained from the computer runs.

Finally the information requirement and the system for providing the alternative choice of schedules to the decision maker for adopting the Multiple Objective approach described in this dissertation were also identified and detailed.