Power Generation Systems Long-term Planning using Reliability Techniques

Long term planning of a reliable and economic supply of electrical energy to customers is an important issue to all power utility managements. The national energy supply has to be very well planned and should be available in the future in order to ensure an adequate and reliable energy source. Important issues are to be considered in the energy system planning studies. These issues are related to the required amount of energy supply, i.e. number of generating units,their sizes and types, which should be added to the existing power network and in what date. Also the national energy system risk level and value before and after the addition of the planned energy supply and the corresponding cost are to be calculated. It must be pointed out that while over investment can lead to a high reliability value of the energy supply, under investment could result in a non-reliable energy system and to a high system risk value which could be outside the international acceptable risk level for electric energy supply systems. Moreover, the probability of consumers being disconnected will be increased as well.

Failures in any part of the energy system can cause interruptions which range from inconveniencing a small number of local residents to a major and widespread catastrophic disruption of power supply and blackouts. The economic impact of these power outages is not restricted to loss of revenue by the power utility or loss of energy utilization by the customer but, in order to estimate true costs, should also include indirect costs imposed on customers, society, and the environment due to the power outage. Economic and reliability constraints can be competitive, and this can lead to difficult managerial decisions at both the planning and operating phases of power systems.
The planned power generation capacity is the installed genertion capacity that must be planned and constructed in advance to meet the forecasted system peak load. A fundamental problem in energy system planning is the correct determination of reserve capacity. Too low a value means excessive interruption, while too high a value results in excessive costs.

Two main reliability techniques are used for this purpose. These techniques are Loss of Load Expextation (LOLE) and Loss of Energy Expectation (LOEE). These techniques are very widely used in the American and Canadian electric power utilities.