

ABSTRACT

Electricity is the basic work horse for the modern society. The ever increasing demand of electricity leads to the electric power utilities to plan for meeting the demand growth in future. Hence operating the power generating systems more efficiently and economically plays an important role. Consequently, power system planners must understand and use optimal planning techniques which helps to achieve the desired objectives.

To meet the demand growth, it is necessary to find the best generation capacity expansion alternative for the power system. That is, selecting the best generation expansion scheme according to load growth. Now, Generation Capacity Expansion Planning (GCEP) plays a key role in the power system planning that determines kind of generating system are need to be commissioned and at the what time horizon they are to be committed to the system over the long term planning.

This study extensively explores the power deficit caused in the State of Tamil Nadu. To solve this problem, GCEP and Demand Side Management (DSM) strategies were adopted. With these strategies reliability of the Tamil Nadu power system try to improve as much as possible. Wien Automatic System Planning – IV (WASP-IV) package is used to analyze the reliability of the considered power system along with economic and environmental pollutant factors.

This thesis is aimed at analyzing the reliability of Tamil Nadu the power systems for the year 2015. By modeling Wind Power Plant on two different basis of Thermal and Hydro capacity of Run-of-River modeling, the reliability indices such as Loss of Load Probability (LOLP) and Energy Not Served (ENS) are computed and compared with Load Generation Balance

Report (LGBR) released by Central Electricity Authority (CEA), Government of India. Based on this analysis, the appropriate and the suitable model along with reliability index, is recommended for long term expansion planning for Tamil Nadu. This reliability index decides the investments on power generations.

For long term GCEP different assumed policy cases were analyzed with and with no Pumped Storage System (PSS) for long term planning of 30 years by making reliability as a constraint, and the suitable penetration level of Renewable Energy Sources (RES) is observed from 10% to 90%. If the penetration of RES increases beyond a certain limit, a storage system is essential to improve the system reliability and stability. The GCEP study is carried out with and without storage system. The effect of storage system on the reliability and the cost is investigated.

For DSM different cases through Load Management Program (LMP) and Energy Reduction Program (ERP) were investigated with and with no PSS for 30 years. Suitable DSM strategies chosen with reliability as a deciding criterion and the Cumulative Least Present Worth Cost (CLPWC) and reduction in pollutants are estimated for long term.

In order to improve the reliability integration of both DSM and Supply Side Management (SSM), is essentially required for a realistic power system. With this integration economic and environmental factors were analyzed, along with reliability through its index Energy Not Served (ENS). From the observed results it could be evident that proper implementation of integrated DSM and SSM strategies yields 1.1 % decrease in nominal capacity of generation plants with 4.5% reduction in generation, 77.7 % decrease in ENS causes 5.2% lower value of CO₂ and SO₂, leads 10.7% and 10.6% reduction in Cumulative Least Present Worth Cost (CLPWC).