

Lecture Notes in Electrical Engineering 607

Akhtar Kalam  
Khaleequr Rehman Niazi  
Amit Soni  
Shahbaz Ahmed Siddiqui  
Ankit Mundra *Editors*

# Intelligent Computing Techniques for Smart Energy Systems

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# Cost–Benefit Analysis in Distribution System of Jaipur City After DG and Capacitor Allocation



Ankush Tandon, Sarfaraz Nawaz and Shahbaz Ahmed Siddqui

**Abstract** Distributed generation (DG) and shunt capacitors are widely adopted for minimizing power loss in distributed networks. But the high cost of DG units puts a limitation on employing higher rating DGs in distribution networks. So, it is desired that less DG size gives maximum loss reduction for achieving the objective of minimum overall cost of the system. The prominent goal of this paper is to curb the total expenditure occurring due to annual energy loss and cost incurred in installing DG units and capacitor banks. An unsullied methodical approach has been presented in this paper to find out optimal position and rating of DG as well as capacitor units so that the overall cost would be minimal. The method is tested on standard IEEE 69 bus distribution system and 130 bus Indian distribution systems. The outcomes of both the test systems are optimistic and found to be promising when compared with the previous ones.

**Keywords** Real power loss (RPL) · Capacitor units · Distributed generation (DG) · Radial distribution system (RDS)

## 1 Introduction

Distributed generation (DG) is used for pollution-free electric power production. The connotation of distributed generation refers to the small generating units which are installed in the neighborhood of the load side in order to avoid the future expansion requirements. The DGs are installed in the system to primarily reduce active power loss which in turn leads to diminution of energy loss with enhancement of voltage profile. The renewable-based DG units (solar PV, windmills, etc.) are generally used for power generation. But the cost of such types of DGs is very high. In India, the cost of 10 kW on a grid solar power plant is around Rs. 5 lacs. It is desirable to

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A. Tandon (✉) · S. Nawaz  
SKIT M&G, Jaipur, India  
e-mail: eeankush.1986@gmail.com

S. A. Siddqui  
Manipal University Jaipur, Jaipur 303007, Rajasthan, India

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