Ain Shams University
Faculty of Engineering
Department of Electrical Power and Machines

Impact of Defective DG on Distribution System Performance

By

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A Thesis Submitted in Partial Fulfillment of the Requirement for the Degree of Master of Science - Electrical Engineering Electrical Power& Machines

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B.Sc. Electrical Engineering, : Faculty of Engineering, OMAR AL-MUKHTAR UNIVERSITY- LIBYA ,2014

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Statement

This thesis is submitted as a partial fulfillment of the Requirement for the Degree of Master of Science in Electrical Engineering Electrical Power& Machines Engineering, Faculty of Engineering, Ain shams University.

The author carried out the work included in this thesis, and no part of it has been submitted for a degree or a qualification at any other scientific entity.

Abdulsalam Arif Aloukili

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Date: / / 2018

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CHAPTER 4: Effect of Partial Outage of DG on System Performance

ABBREVIATIONS

AI	Artificial Intelligence
DG	Distributed generation
GA	Genetic Algorithm
HM	Harmony Memory
HMCR	Harmony Memory Consideration Rate
HMS	Harmony Memory Size
HSA	Harmony Search Algorithm
IA…	Improved Analytical…
kVA	Kilo Volt Ampere
kVAr	Kilo Volt Ampere reactive (unit of reactive power)
kW	Kilo Watt (units of active power)
LSF	Loss Sensitivity Factor
Max	Maximum
Min	Minimum
PAR	pitch adjusting rate
PSO	Particle Swarm Optimization
CSC	Controlled switched capacitor
SQP	Sequential quadratic programming

ABSTRACT

In the last decades, the growing demand on electricity lead researchers to develop new methods for generating enough power to meet it partly by generating electricity distribution system and to improve power quality in client's side. Distributed generation (DG) is one of those methods. DG is widely used in modern networks and lead to changes in performance of distribution systems. The advantages that can be added to distribution system through using the DG's are mainly improvement of voltage profile and power quality. Thus, DG is preferable to be installed in distribution system near clients to enhance the system performance while reducing power losses and improve voltage in this grid. Recently, DG became highly important and its penetration increased in most of the distribution systems. This thesis studies the effects of distributed generation outage from the system on its performance and behavior. The model of DG's in this study assume two cases to the power that provided into network, where in the first case considered DG units inject just active power to the grid (unity power factor). In the second case the used DG injects both active and reactive power to the system. Where many types of DG as (inverted based connected with photovoltaic, full cell or micro wind& combined heat and power) can be used. The sizing is done by using harmony search algorithm (HSA) while the locations are selected by ranking of the network buses. This work was done on IEEE 33 bus system with 100% dynamic loads. The dynamic loads are selected after comparison between many types of loads (static loads, both static and dynamic loads) where it is considered to be the worst type of load. After that, outage of DG units is fixed by injecting reactive power source (capacitor with-controlled switch) to compensate the outage of DGs from the distribution system and to reduce the effect appeared on the network due to this outage. The sizing of capacitors is optimized by using harmony search algorithm (HSA) in same place of the DG units.

Keywords: inverter based DG, dynamic load, outage and shunt capacitors , active power , reactive power, static load.

Chapter 1: Introduction

1.1 Introduction

Electric energy became one of the most important basics of modern life and the demand on this energy increases consciously. This situation led to some challenges as to increase the generation to meet the growing demand. But the big challenges are how to provide this increasing of demand by the lowest cost to introduce service to costumer by lower price to be acceptable. The traditional method that was followed to produce the electricity and transmit it to the customers will be described below.

1.2 Conventional Method to Generate and Transmit Power

The conventional method to produce and deliver electrical power from conventional power stations to clients is passing through several stages. Electricity is usually produced in large power plants located far away from customers to decrease the cost of generation and to take the requirement of environmental issues and noise into consideration. After that this power is transmitted by transmission lines or underground cables after setting up the voltage to reduce the power losses. This stage is expensive due to the cost of installation of towers or Excavation works. Then stepping down the voltage of the distribution system is the final stage to provide the customers by electricity. The demand of this energy became continuously, which pushes the generation side to produce more power in order to meet the demand requirements that mean not just additional generators but also lead to upgrade the transmission lines and distribution system to be able to take more power from centralized plant to customers that requires and lead to pay more money, Fig (1.1) shows traditional power flow from centralized station to customer.

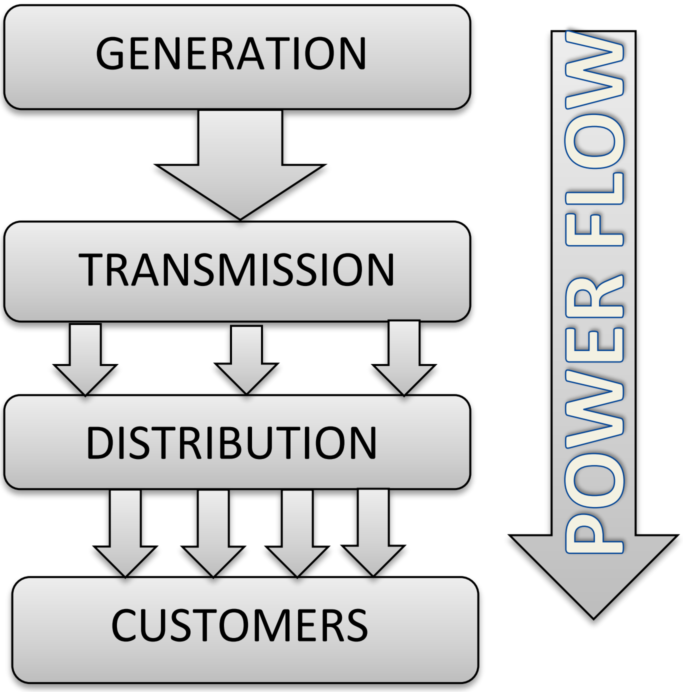

Fig. 1.1 Traditional power flow in conventional power system

The impact of the fossil fuel centralized plant on the greenhouse phenomena plays an important role to push researchers to enhance the methods to generate electricity from renewable source as wind turbines, photovoltaic and other methods. The activity and reliability of power generated from fossil fuel is more than the power generated from renewable resources. That led to improving those methods to reduce the difference between power generated from fossil fuel and that from renewable resources. Also, the storage element may be needed in some