

Impact of Distributed Generation on Voltage Profile and Losses of Distribution Network

BY

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CERTIFICATE

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DECLARATION OF AUTHORSHIP

I hereby declare that content of this thesis is my own work and that it is the result of work done during the period of registration. To the best of my knowledge, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgement has been made in the text.

Parts of this thesis appeared in the following publication, to which I have made substantial contributions:

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ABSTRACT

Energy crises are rising all over the world. The demand of electricity is increasing as the industrialization as well as the population of the World is increasing day by day. In this context not only the energy production is a key to fulfil consumer demands but also the losses of the distribution network need to be minimized. In addition to this, Electricity has to be delivered within the claimed levels by the utility to the end consumer. Distributed generation (DG) together with the centralized generation (CG) can be used to fulfil the energy demands.

Distributed generation integration into the system can improve the voltage profile of the system as well as reduce the losses of the system, though it depends on the nature of a distributed generation source as well as its location of integration into the system.

In this research project, work has been done on the system to improve its voltage profile, minimize the amount of losses of the network and enhance energy production. For this purpose, a test system is designed in ETAP and this test system is analyzed with and without the impact of different DG sources. Different DG sources with different nature from each other are selected for test purposes. These sources include synchronous generator, wind turbine generator and photovoltaic modules. These DG sources are designed in ETAP and then integrated into the test system. After simulation of different DG scenarios results are compared with the base cases and recommendation are made.

Keywords: Distributed Generation, Distributed Generation Integration, Point of Common Coupling, Voltage Profile Improvement, Power Losses, Renewable Energy, Photovoltaic, Wind Turbine Generator, Synchronous Generator.

TABLE OF CONTENTS

Certificate.....	ii
Declaration of Authorship	iii
Acknowledgements	iv
Abstract	v
Table of Contents.....	vi
List of Figures	x
List of Tables	xiii
Abbreviations.....	xvi
Chapter 1 Introduction	
1.1 Conventional Power System	2
1.2 Modified Power System	3
1.3 Distributed Generation	3
1.4 Applications of DG.....	4
1.5 Thesis Objectives.....	4
1.6 Thesis Structure	4
1.6.1 Outlines of the chapters	5
Chapter 2 Literature Review	
2.1 Introduction	7
2.2 Types of Distributed Generation.....	10
2.2.1 Photovoltaics.....	10
2.2.2 Wind Turbines	11
2.2.3 Micro Turbines	12
2.2.4 Fuel Cells	13
2.2.5 Induction and Synchronous Generators.....	14
2.3 Centralized Generation Vs Distributed Generation.....	15
2.4 Islanding Mode	16

2.4.1 Intentional Islanding	17
2.4.2 Unintentional Islanding	17
2.5 Voltage and Power Impact of DG	17

Chapter 3 Research Methodology

3.1 Research Objectives	22
3.2 Tasks	22
3.3 Assumptions	22
3.4 Methodology	23
3.4.1 ETAP	24
3.4.2 Selected Grid	24
3.4.3 Loading, CT Ratio and Calculated Amperes of Feeders..	25
3.4.4 Number of Consumers	26
3.4.5 Distribution Transformers of the Grid	27
3.4.6 Cables Data of the Grid	28
3.5 Circuit Description	30
3.5.1 Single Line Diagram	30
3.5.2 Test Feeder's Single Line Diagram.....	31
3.6 Designed DG Scenarios	32
3.6.1 Designed/ Modeled Synchronous Generator.....	32
3.6.1.1 Ratings.....	32
3.6.1.2 Type.....	32
3.6.1.3 Grounding.....	33
3.6.2 Wind Turbine Generator	33
3.6.2.1 WTG Type.....	33
3.6.2.2 Rating	33
3.6.2.3 Turbine Ratings	33
3.6.2.4 Grounding.....	33
3.6.2.5 Power Curve	33
3.6.3 Photovoltaic.....	34

3.6.3.1 PV Type.....	34
3.6.3.2 Ratings.....	34
3.6.3.3 PV Array	34
3.6.3.4 Module Dimensions	34

Chapter 4

4.1 Designed Scenarios	37
4.2 Testing the System without DG Sources.....	37
4.3 Testing the System with DG Sources.....	37
4.4 Scenario A: With Synchronous Generator	38
4.4.1 Scenario A1: With DG unit at Bus 2.....	38
4.4.2 Scenario A2: With DG unit at Bus 3.....	40
4.4.3 Scenario A3: With DG unit at Bus 4.....	41
4.4.4 Scenario A4: With DG unit at Bus 5.....	43
4.4.5 Scenario A5: With DG unit at Bus 6.....	45
4.4.6 Scenario A6: With DG unit at Bus 7.....	47
4.5 Scenario B: With Wind Turbine Generator.....	49
4.5.1 Scenario B1: With DG unit at Bus 2	49
4.5.2 Scenario B2: With DG unit at Bus 3	51
4.5.3 Scenario B3: With DG unit at Bus 4	53
4.5.4 Scenario B4: With DG unit at Bus 5	55
4.5.5 Scenario B5: With DG unit at Bus 6	57
4.5.6 Scenario B6: With DG unit at Bus 7	59
4.6 Scenario C: With Photovoltaic	61
4.6.1 Scenario C1: With DG unit at Bus 2	62
4.6.2 Scenario C2: With DG unit at Bus 3	63
4.6.3 Scenario C3: With DG unit at Bus 4	65
4.6.4 Scenario C4: With DG unit at Bus 5	67
4.6.5 Scenario C5: With DG unit at Bus 6	69

4.6.6 Scenario C6: With DG unit at Bus 7	71
4.7 Bus Wise Impact on Voltage Profile and Losses with DG Sources	73
4.7.1 Injection Point Being Bus Number 2	74
4.7.2 Injection Point Being Bus Number 3	75
4.7.3 Injection Point Being Bus Number 4	76
4.7.4 Injection Point Being Bus Number 5	77
4.7.5 Injection Point Being Bus Number 5	78
4.7.6 Injection Point Being Bus Number7	79
 Chapter 5 Summary and Conclusion	
5.1 Voltage Profile Summary	81
5.2 Active Power Losses	82
5.3 Reactive Power Losses	83
5.4 Summary and Conclusion	84
 References.....	85

LIST OF FIGURES

	<i>Page Number</i>
Fig 1.1 Conventional Power System.....	2
Fig 1.2 Modified Power System	3
Fig 2.1 Components of Typical PV	11
Fig 2.2 Schematic Arrangement of a Typical Wind Turbine.....	12
Fig 2.3 Schematic Arrangement of Micro Turbine.....	13
Fig 2.4 Typical Fuel Cell Arrangement	14
Fig 3.1 DGs integration into the System.....	23
Fig 3.2 Single Line Diagram of the Grid	30
Fig 3.3 Test System.....	31
Fig 3.4 Power Curve of WTG.....	34
Fig 4.1 Effect on Voltage Profile with SG at Bus 2.....	39
Fig 4.2 Effect on Losses with SG at Bus 2.	39
Fig 4.3 Effect on Voltage Profile with SG at Bus 3.....	40
Fig 4.4 Effect on Losses with SG at Bus 3	41
Fig 4.5 Effect on Voltage Profile with SG at Bus 4.....	42
Fig 4.6 Effect on Losses with SG at Bus 4	43
Fig 4.7 Effect on Voltage Profile with SG at Bus 5.....	44
Fig 4.8 Effect on Losses with SG at Bus 5	45
Fig 4.9 Effect on Voltage Profile with SG at Bus 6.....	46
Fig 4.10 Effect on Losses with SG at Bus 6	47

Fig 4.11	Effect on Voltage Profile with SG at Bus 7.....	48
Fig 4.12	Effect on Losses with SG at Bus 7	49
Fig 4.13	Effect on Voltage Profile with WTG at Bus 2.....	50
Fig 4.14	Effect on Losses with WTG at Bus 2	51
Fig 4.15	Effect on Voltage Profile with WTG at Bus 3.....	52
Fig 4.16	Effect on Losses with WTG at Bus 3	53
Fig 4.17	Effect on Voltage Profile with WTG at Bus 4.....	54
Fig 4.18	Effect on Losses with WTG at Bus 4.	55
Fig 4.19	Effect on Voltage Profile with WTG at Bus 5.....	56
Fig 4.20	Effect on Losses with WTG at Bus 5	57
Fig 4.21	Effect on Voltage Profile with WTG at Bus 6.....	58
Fig 4.22	Effect on Losses with WTG at Bus 6.	59
Fig 4.23	Effect on Voltage Profile with WTG at Bus 7.....	60
Fig 4.24	Effect on Losses with WTG at Bus 7	61
Fig 4.25	Effect on Voltage Profile with PV at Bus 2.....	62
Fig 4.26	Effect on Losses with PV at Bus 2	63
Fig 4.27	Effect on Voltage Profile with PV at Bus 3.....	64
Fig 4.28	Effect on Losses with PV at Bus 3	65
Fig 4.29	Effect on Voltage Profile with PV at Bus 4.....	66
Fig 4.30	Effect on Losses with PV at Bus 4	67
Fig 4.31	Effect on Voltage Profile with PV at Bus 5.....	68
Fig 4.32	Effect on Losses with PV at Bus 5	69
Fig 4.33	Effect on Voltage Profile with PV at Bus 6.....	70

Fig 4.34	Effect on Losses with PV at Bus 6	71
Fig 4.35	Effect on Voltage Profile with PV at Bus 7.....	72
Fig 4.36	Effect on Losses with PV at Bus 7	73
Fig 5.1	Summary of Voltage Profile of Test System.....	81
Fig 5.2	Active Power's Summary of Test System.....	82
Fig 5.3	Reactive Power's Summary of Test System.....	83

LIST OF TABLES

	<i>Page Number</i>
Table 2.1	Categorization of DG Units9
Table 2.2	DG Components and Available Sizes per Module9
Table 2.3	Centralized Generation Vs Distributed Generation16
Table 3.1	Feeders Data of Cantt Grid25
Table 3.2	Number of Consumers26
Table 3.3	Distribution Transformers Ratings27
Table 3.4	Feeder Wise Transformers Ratings (in kVA)28
Table 3.5	Conductors Data of the Grid29
Table 3.6	Test System's Transformers Ratings32
Table 3.7	PV module dimensions35
Table 4.1	Effect on Voltage of System with SG on Bus 238
Table 4.2	Effect on Losses of System with SG on Bus 239
Table 4.3	Effect on Voltage of System with SG on Bus 340
Table 4.4	Effect on Losses of System with SG on Bus 341
Table 4.5	Effect on Voltage of System with SG on Bus 442
Table 4.6	Effect on Losses of System with SG on Bus 443
Table 4.7	Effect on Voltage of System with SG on Bus 544
Table 4.8	Effect on Losses of System with SG on Bus 545
Table 4.9	Effect on Voltage of System with SG on Bus 646
Table 4.10	Effect on Losses of System with SG on Bus 647
Table 4.11	Effect on Voltage of System with SG on Bus 748

Table 4.12	Effect on Losses of System with SG on Bus 7	49
Table 4.13	Effect on Voltage of System with WTG on Bus 2	50
Table 4.14	Effect on Losses of System with WTG on Bus 2	51
Table 4.15	Effect on Voltage of System with WTG on Bus 3	52
Table 4.16	Effect on Losses of System with WTG on Bus 3	53
Table 4.17	Effect on Voltage of System with WTG on Bus 4	54
Table 4.18	Effect on Losses of System with WTG on Bus 4	55
Table 4.19	Effect on Voltage of System with WTG on Bus 5	56
Table 4.20	Effect on Losses of System with WTG on Bus 5	57
Table 4.21	Effect on Voltage of System with WTG on Bus 6	58
Table 4.22	Effect on Losses of System with WTG on Bus 6	59
Table 4.23	Effect on Voltage of System with WTG on Bus 7	60
Table 4.24	Effect on Losses of System with WTG on Bus 7	61
Table 4.25	Effect on Voltage of System with PV on Bus 2	62
Table 4.26	Effect on Losses of System with PV on Bus 2	63
Table 4.27	Effect on Voltage of System with PV on Bus 3	64
Table 4.28	Effect on Losses of System with PV on Bus 3	65
Table 4.29	Effect on Voltage of System with PV on Bus 4	66
Table 4.30	Effect on Losses of System with PV on Bus 4	67
Table 4.31	Effect on Voltage of System with PV on Bus 5	68
Table 4.32	Effect on Losses of System with PV on Bus 5	69
Table 4.33	Effect on Voltage of System with PV on Bus 6	70
Table 4.34	Effect on Losses of System with PV on Bus 6	71

Table 4.35	Effect on Voltage of System with PV on Bus 7	72
Table 4.36	Effect on Losses of System with PV on Bus 7	73
Table 4.37	Voltage Profile with Injection of DG Sources at Bus Number 2.....	74
Table 4.38	Power Losses with Injection of DG Sources at Bus Number 2	74
Table 4.39	Voltage Profile with Injection of DG Sources at Bus Number 3	75
Table 4.40	Power Losses with Injection of DG Sources at Bus Number 3	75
Table 4.41	Voltage Profile with Injection of DG Sources at Bus Number 4.....	76
Table 4.42	Power Losses with Injection of DG Sources at Bus Number 4	76
Table 4.43	Voltage Profile with Injection of DG Sources at Bus Number 5.....	77
Table 4.44	Power Losses with Injection of DG Sources at Bus Number 5	77
Table 4.45	Voltage Profile with Injection of DG Sources at Bus Number 6.....	78
Table 4.46	Power Losses with Injection of DG Sources at Bus Number 6	78
Table 4.47	Voltage Profile with Injection of DG Sources at Bus Number 7.....	79
Table 4.48	Power Losses with Injection of DG Sources at Bus Number 7	79

ABBREVIATIONS

- DG:** Distributed Generation
- ETAP:** Electrical Transient Analyzer Program
- CG:** Centralized Generation
- PV:** Photovoltaic
- WTG:** Wind Turbine Generator
- SG:** Synchronous Generator
- IEA:** International Energy Agency
- GW:** Gigawatt
- MW:** Megawatt
- IEEE:** Institute of Electrical and Electronics Engineers
- CIGRE:** International Council on Large Electricity Systems
- EPRI:** Electric Power Research Institute
- DC:** Direct Current
- AC:** Alternating Current
- MPPT:** Maximum Power Point Tracking system
- MVA:** Mega Volt Ampere
- MVAR:** Mega Volt Amperes Reactive
- MW:** Megawatts
- WECC:** Western Electricity Coordinating Council
- WAPDA:** Water and Power Development Authority
- PESCO:** Peshawar Electric Supply Company