International Journal of Engineering Sciences, 2(8) August 2013, Pages: 350-360

TI Journals

International Journal of Engineering Sciences

www.tijournals.com

ISSN
2306-6474

A Comparative Study on Implementation of Genetic Algorithm (GA) and ATC to Generator Siting in Nigerian 330KV Power Network

A. A. Sadiq *[1], M. N. Nwohu [2], J. G. Ambafi [3]

[1,2,3] *Department of Electrical and Electronics Engineering, Federal University of Technology, Minna. Nigeria.*

ARTICLE INFO

Keywords:
Generator Siting
Genetic Algorithm (GA)
Available Transfer Capability (ATC)
Power Network
Power loss

ABSTRACT

As the Nigerian electricity market tends towards deregulation thereby encouraging Independent Power Producers (IPP), one key issue is the optimal location of their generating units for a given network. In this paper, the application of Available Transfer Capability (ATC) expected values among selected candidate buses is used as criterion to siting of new generator. However, Genetic algorithm (GA) approach is employed to locate the optimal bus for siting a new generation resource and a comparison between the use of ATC level index and GA is made. The results shows that the use of genetic algorithm for real power loss minimization is a better technique for optimal generator siting when compared with ATC level index.

1. Introduction

As the Nigerian electric power industry is tending to a competitive and deregulated electricity market in order to meet the ever-increasing electricity demand in the country, there is the need for an index for decision making on trading strategies and reliable operations, better location of new generation resources and generation investment plans thereby enhancing the economic incentive to Independent Power Producers (IPP). Moreover, location of new traditional large thermal plants and the need for transmission grid expansion are becoming difficult in a regulated power structure due to environmental and economic issues, hence, deregulation tends to favour private plants managed and operated by independent power producers (IPP). One key issue for these private plants is the optimal location of their generation units for a given network [1]. Often the economic benefit accrue to a given location is an important factor in the siting of new generation resources by private power operators. Various indices are used in the location of new generators, namely, ATC level [1], Locational Marginal Pricing [2], as well as the optimal siting and sizing of distributed generation which are either based on loss sensitivity on bus voltage [3, 4] or heuristic approaches which are based on optimization [5-12]. In this paper, two approaches; ATC level and use of Genetic algorithm (GA) based on real power loss minimization are used for siting new generation resources in the Nigerian 330KV power network, performance comparison is made between ATC level as index and the use of GA as criterion to locate new generation resources. The basic idea is to optimally locate a new generation resource capable of supplying the increase in a given area load. In the case study considered here (Nigerian Grid) four (4) new suitable buses (one in each area) will be identified as the optimal buses amongst a given Area candidate buses, and the optimal bus in the entire network also established.

2. Available transfer capability implementation

2.1 Available Transfer Capability level Index

For some given area candidate buses, estimate of the probability distribution of ATC from these candidates' buses to other locations within the area could be used as guide in appropriate location of new generation resources [1]. The ATC level index favours the location (bus) with higher ATC values thereby resulting in additional amount of power transferable from a given location. At a given market price, higher Transfer Capability level implies the likelihood of engaging in bilateral and multilateral transaction which could accrue more economic benefit for the IPP.

2.2 The Nigerian 330kV Network

Nigerian 330KV voltage level heretofore referred to as the Nigerian grid. In PSAT environment, the Nigerian grid is a power network of thirty two (32) buses, twenty seven (27) transmission lines and seven (7) generating stations. The installed generating capacity of the Nigerian grid is 7, 461MW including hydro resources and gas fired (thermal). The Nigerian grid is made up of 5, 523.8km of 330 kV transmission lines and thirty two (32) 330/132kV substations with total installed transformation capacity of 7, 688 MVA (equivalent to 6, 534.8 MW). The Average Available Capacity on 330/132kV is 7, 364MVA which is about 95.8% of Installed capacity [13,14]. The Nigerian grid system, in this research work, is zoned into four geographical areas in conformity with the control structure of the electric

---

* Corresponding author.
Email address: ahmad.abubakar@futminna.edu.ng

utility, Power Holding Company of Nigeria (PHCN). Table 1 gives the location of the seven power generating station and their respective installed capacity. Table 2 shows the Transmission line parameters and the line thermal limit of the Nigerian grid while Figure 1 shows the one line diagram of the Nigerian grid identifying the Areas.

Table 1. Electricity Power Stations of the Nigerian Power Grid.

Power Station	Egbin	Sapele	Afam	Delta	Kainji	Shiroro	Jebba
Type/Fuel Used	Gas	Thermal	Thermal	Thermal	Hydro	Hydro	Hydro
Installed Capacity(MW)	1320	1020	969.6	912	760	600	578.4

Source: PHCN (2004)

2.3 Location Using ATC level index

Hybridized continuous-repeated power flow structure is used to evaluate the ATC. A reformulation of the power flow equation is required to apply continuation method to power flow problem. A loading parameter (λ) is inserted into the power flow equations to parameterize the load-flow equation [15]. A constant power load model is documented in [16] and at the maximum loading parameter (λ_{max}), the ATC is calculated using equation (1)

$$ATC = \sum_{i \in \sin k} P_L^i(\lambda_{\max}) - \sum_{i \in \sin k} P_L^{i_0} \tag{1}$$

3. Genetic algorithm (GA) implementation

3.1 Genetic Algorithm (GA)

Genetic algorithm is a search technique based on natural genetics and inspired by evolution [17]. Individuals are selected based on defined fitness level. For a given population (candidate buses), total network real power loss will be minimized and the voltage deviation away from 1.0p.u measured. The bus which results in least real power loss less than the base case (before siting a new generator) is considered ideal for better location of a new generator. A ratio of grid loss after and before siting of generator at all candidate buses is an important output of GA thereby identifying the optimal candidate bus within an area.

3.2 Optimal Location Using Genetic Algorithm

The fitness function considered is made up of two terms, the real power loss ratio and the voltage deviation term. The total network real power loss by Newton Raphson Power flow method (N-R) in electric network is defined as in equation (2).

$$P_{loss} = \sum_{i}^{n} (P_G - P_L) = P_{loss}^{grid} \tag{2}$$

where P_G and P_L is the total real power injected and total real power demand of the grid.

The ratio of P_{loss}^{grid} after and before the location of new generation at all candidate buses are considered for minimization. Ideally, it is desired that all network bus voltages be maintained at 1.0p.u, the voltage deviation term measures the deviation in voltage of the candidate bus from this desired value and the bus with higher or lower voltage value which is penalized by adding the deviation value to the fitness function value.

3.3 Genetic Algorithm (GA) objective function

We therefore defined the fitness function as:

Min.

$$f(P_{loss}^{grid\_i}, V_i) = \frac{P_{loss}^{grid\_i}}{P_{loss}^{grid\_0}} + |1 - V_i| \tag{3}$$

Subject to:

$$P_{loss}^{grid\_i} \le P_{loss}^{grid\_0} \tag{4}$$

$$0.9 \le V_i \le 1.1\text{p.u} \tag{5}$$

So that $P_{loss}^{grid\_0}$ is the total grid loss before location, which is expected to be same for all candidate buses and $P_{loss}^{grid\_i}$ is the total grid loss after locating a new generator at the ith bus. V_i is the ith bus voltage before the location of a generator since it is desired to keep that bus at 1.0p.u by making it the slack bus, thereby supplying the network real power loss. The total grid loss before placement is $P_{loss}^{grid\_0} = 39.077MW$

Chromosomes are eliminated or duplicated according to the fitness function value. All solutions obtained which satisfy equation (3) and (4) are registered and compared. The bus with the least fitness function value among an area candidate buses is considered the optimal solution for the propose location.

Number of generation = total number of candidate buses.

Generally, all PQ buses (load buses) are candidate buses. However, for convenience and approach by PSAT GUI model, the following buses are excluded as candidate buses

- All existing generator buses
- All HT (High Tension) buses
- All TS (Transmission substation) buses.

Area one has eight PQ buses six of which are candidate buses, Area two is made up of six PQ buses, out of which four are selected as candidates. In Area three, there are four PQ buses, two of which are candidate buses. Similarly, Area four consists of four PQ buses, three are the candidate buses. In total, we have fifteen candidate buses out of the 32 network buses. Table 3 shows all candidate bus numbers, location description and their corresponding Areas.

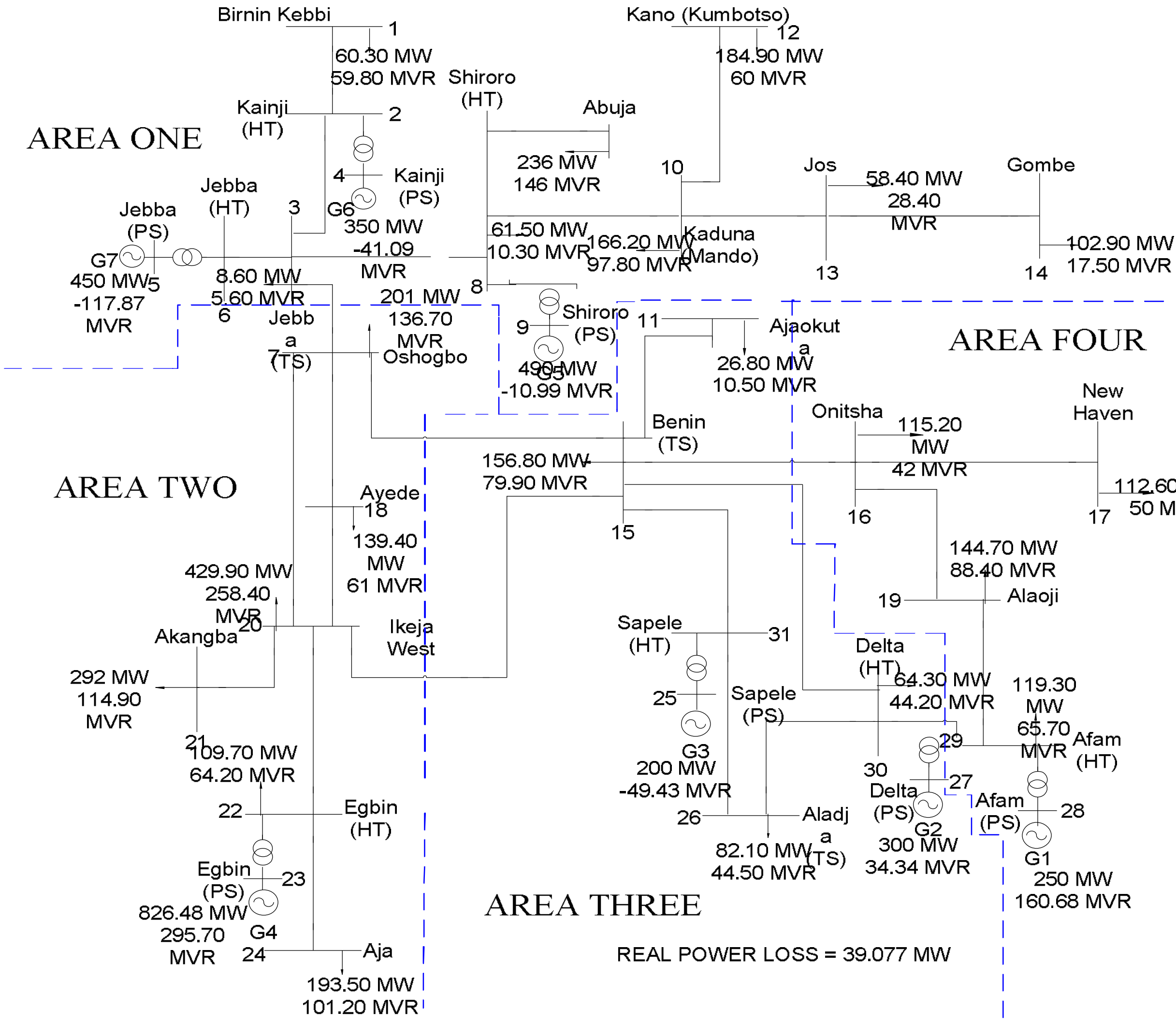

Figure 1. One line diagram of Nigerian power Grid System.

Table 2. Transmission Line data of Nigerian Grid.
*100MVA base for p.u. values.

LINE NO.	LOCATION DESCRIPTION I	LOCATION DESCRIPTION J	LINE PARAMETERS (P.U.)*			Thermal Rating (AMPS)	Thermal Rating (MVA)
			R	X	B		
1	kainji (HT)	Birnin kebbi	0.01218	0.09163	1.0269	1360	777.4
2	kainji (HT)	Jebba (TS)	0.00159	0.01197	0.5366	1360	777.4
3	Kainji (PS)	Kainji (HT)	0	0.01351	0		860
4	Jebba (HT)	Jebba (TS)	0.00016	0.00118	0.053	1360	777.4
5	Jebba (TS)	Oshogbo	0.00206	0.01547	1.56	1360	777.4
6	Shiroro (HT)	Jebba (TS)	0.0048	0.03606	1.6165	1360	777.4
7	Jebba (PS)	Jebba (HT)	0	0.01932	0		714
8	Oshogbo	Benin(TS)	0.00987	0.07419	0.8315	1360	777.4
9	Oshogbo	Ayede	0.00412	0.03098	0.3472	1360	777.4
10	Oshogbo	Ikeja West	0.01163	0.0875	0.9805	1360	777.4
11	Shiroro (PS)	Shiroro (HT)	0	0.01638	0		800
12	Shiroro (HT)	Kaduna(Mando)	0.00189	0.01419	0.636	1360	777.4
13	Kaduna(Mando)	Kano(Kumbotso)	0.00904	0.06799	0.7619	1360	777.4
14	Kaduna(Mando)	Jos	0.00774	0.05832	0.6526	1360	777.4
15	Benin(TS)	Ajaokuta	0.00766	0.05764	0.646	1360	777.4
16	Jos	Gombe	0.01042	0.07833	0.8778	1360	777.4
17	Ayede	Ikeja West	0.00538	0.0405	0.4538	1360	777.4
18	Ikeja West	Benin(TS)	0.0055	0.04139	1.885	1360	777.4
19	Delta (HT)	Benin(TS)	0.00287	0.02158	0.2418	1360	777.4
20	Sapele (HT)	Benin(TS)	0.00098	0.00739	0.3313	1360	777.4
21	Onitsha	New haven	0.00377	0.02838	0.318	1360	777.4
22	Alaoji	Onitsha	0.00605	0.04552	0.5101	1360	777.4
23	Benin(TS)	Onitsha	0.00538	0.0405	0.454	1360	777.4
24	Afam (HT)	Alaoji	0.00049	0.00369	0.1656	1360	777.4
25	Ikeja West	Akangba	0.00036	0.00266	0.119	1360	777.4
26	Egbin (HT)	Ikeja West	0.00122	0.00916	0.4108	1360	777.4
27	Egbin (PS)	Egbin (HT)	0	0.00648	0		1620
28	Egbin (HT)	Aja	0.00028	0.00207	0.0928	1360	777.4
29	Sapele (PS)	Sapele (HT)	0	0.01204	0		1177
30	Delta (HT)	Alaodja	0.00102	0.00769	0.08613	1360	777.4
31	Sapele (HT)	Alaodja	0.00248	0.01862	0.2087	1360	777.4
32	Delta (PS)	Delta (HT)	0	0.01333	0		720
33	Afam (PS)	Afam (HT)	0	0.01422	0		504
34	Shiroro (HT)	Katampe (Abuja)	0.0025	0.0195	0.413	1360	777.4

Source: PHCN (2004).

Table 3. Candidate buses for siting new generation Resources

Bus Num.	Bus Location	Bus Type	Area Num.
Bus1	Birnin Kebbi	PQ	1
Bus4	Kano	PQ	1
Bus10	Kaduna	PQ	1
Bus13	Jos	PQ	1
Bus14	Gombe	PQ	1
Bus32	Abuja	PQ	1
Bus8	Akangba	PQ	2
Bus9	Ayede	PQ	2
Bus23	Aja	PQ	2
Bus29	Ikeja West	PQ	2
Bus5	Aladja	PQ	3
Bus11	Ajaokuta	PQ	3
Bus6	Onitsha	PQ	4
Bus 17	New haven	PQ	4
Bus19	Alaoji	PQ	4

Figure 2 shows the flow chart of the Genetic algorithm method for real power loss minimization.

Figure 3 represent Area one simulink model of the Nigeria 330KV Power Grid.

Figure 4 represents Area two, three and four simulink model of Nigeria 330KV power Grid.

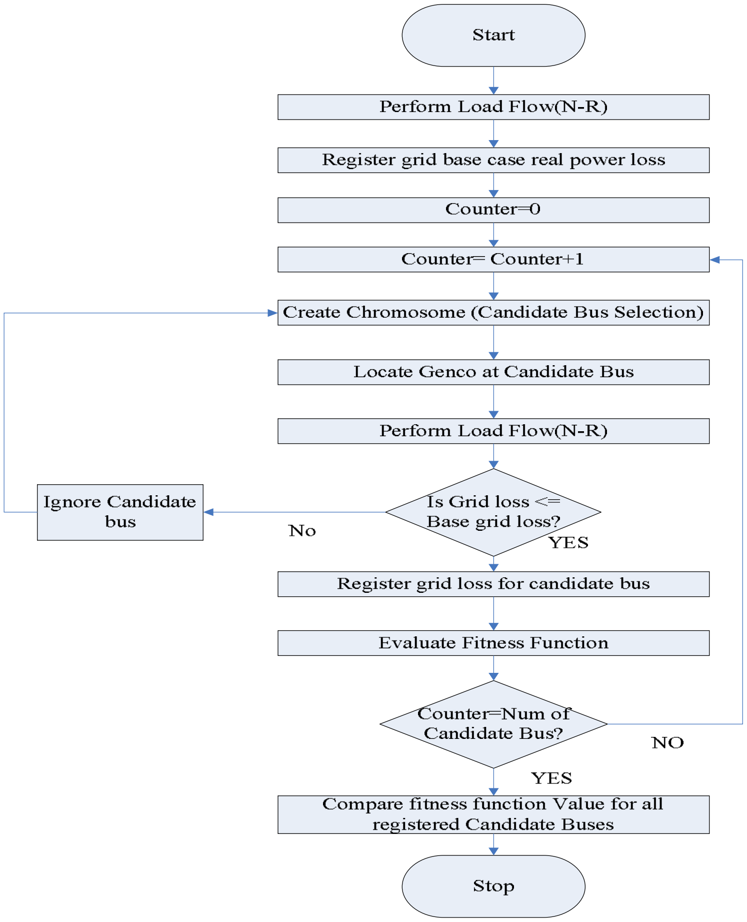

Figure 2. Flowchart of GA Algorithm for optimal location of new generation resource.

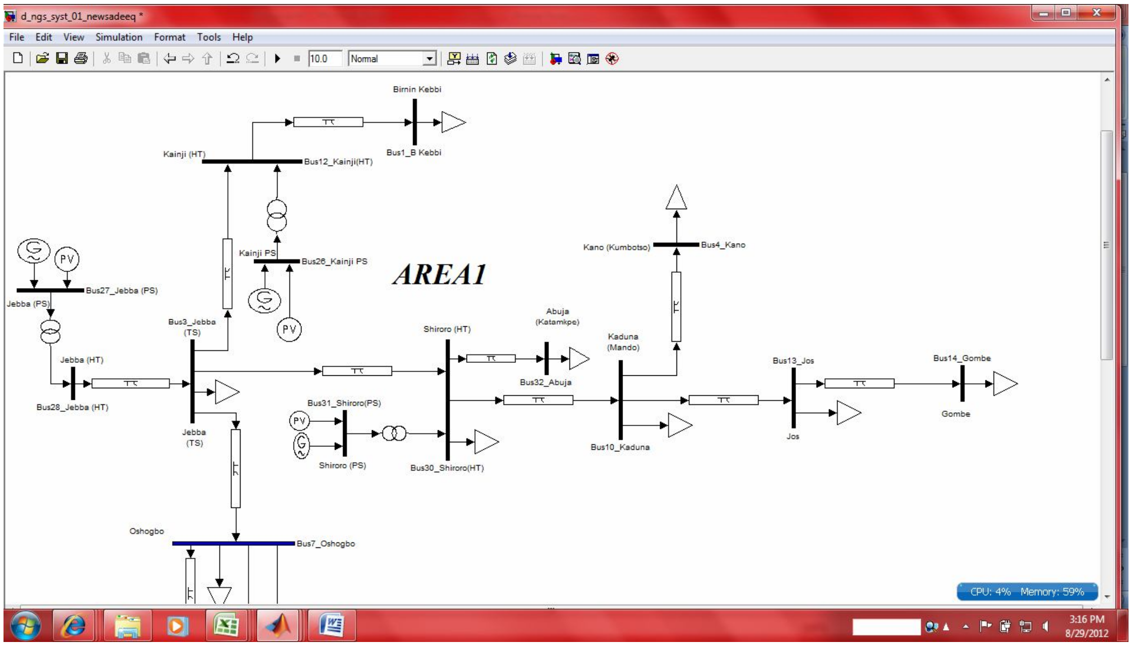

Figure 3. Area One PSAT Model of Nigeria Power Grid.

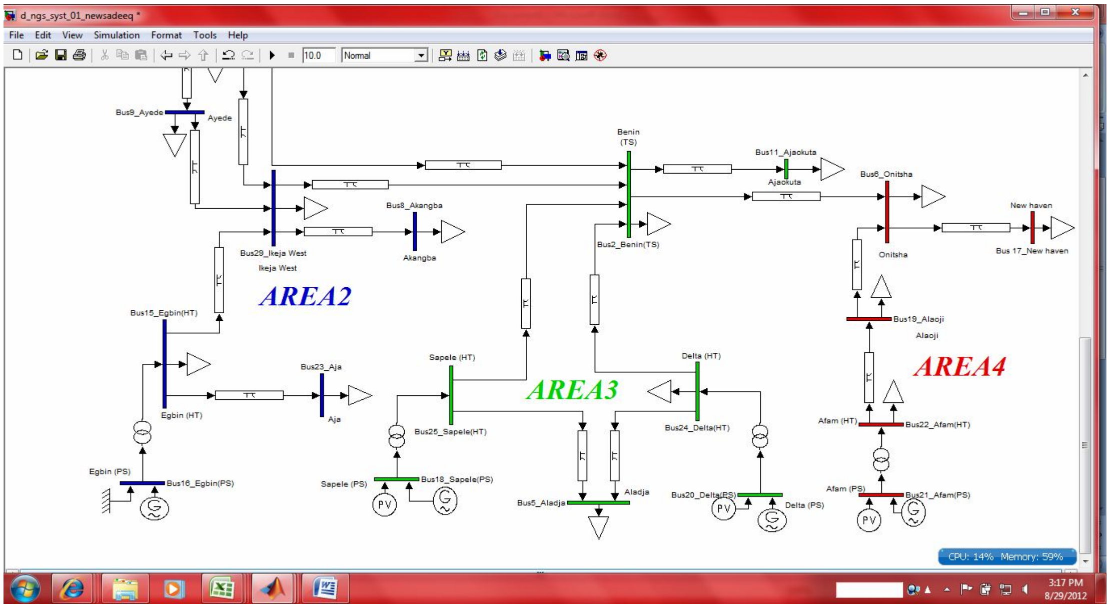

Figure 4. Area Two, Three and Four PSAT Model of Nigeria Power Grid

4. Results

4.1 ATC Computed Values

The use of ATC level as indicator for optimal siting of generation resources was studied and probability distribution of inter-area ATC values between candidate PQ buses are presented in Tables 4 to 7. Tables 4, 5, 6, and 7 give the ATC expected values among different PQ buses in Area 1, Area 2, Area 3 and Area 4 respectively. The ATC values of Tables 4 through 7 were used to plot Figures 5 through 8 and were discussed in the following sub-headings.

Table 4. ATC expected values among candidate PQ buses in Area 1 of Nigeria Grid

ATC Expected values from bus 1 to other buses (MW)								
S/No.	From Bus	1	1	1	1	1	1	1
1	To Bus	3	4	10	13	14	30	32
	ATC (MW) CPFLOW/RPF	219.44	67.91	170.77	117.64	64.4	212.53	203.85
ATC Expected values from bus 4 to other buses (MW)								
	From Bus	4	4	4	4	4	4	4
2	To Bus	1	3	10	13	14	30	32
	ATC (MW) CPFLOW/RPF	78.95	632.35	535.77	173.9	123.72	648.96	307.25
ATC Expected values from bus 10 to other buses (MW)								
	From Bus	10	10	10	10	10	10	10
3	To Bus	1	3	4	13	14	30	32
	ATC (MW) CPFLOW/RPF	77.66	823.47	106.42	209.16	128.62	1033.9	329.13
ATC Expected values from bus 13 to other buses (MW)								
	From Bus	13	13	13	13	13	13	13
4	To Bus	1	3	4	10	14	30	32
	ATC (MW) CPFLOW/RPF	78.13	587.2	81.57	300.39	232.01	622.74	275.17
ATC Expected values from bus 14 to other buses (MW)								
	From Bus	14	14	14	14	14	14	14
5	To Bus	1	3	4	10	13	30	32
	ATC (MW) CPFLOW/RPF	78.21	366.12	80.91	217.56	277.28	359.32	249.82
ATC Expected values from bus 32 to other buses (MW)								
	From Bus	32	32	32	32	32	32	32
6	To Bus	1	3	4	10	13	14	30
	ATC (MW) CPFLOW/RPF	78.65	717.87	92.89	208.02	149.44	110.24	740.63

Table 5. ATC expected values among candidate PQ buses in Area 2 of Nigeria Grid

ATC Expected values from bus 8 to other buses (MW)						
S/NO	From Bus	8	8	8	8	8
1	To Bus	7	9	15	23	29
	ATC (MW) CPFLOW/RPF	772.44	597.31	397.25	385.01	750.96
ATC Expected values from bus 9 to other buses (MW)						
	From Bus	9	9	9	9	9
2	To Bus	7	8	15	23	29
	ATC (MW) CPFLOW/RPF	978.52	276.30	180.09	193.55	217.88
ATC Expected values from bus 23 to other buses (MW)						
	From Bus	23	23	23	23	23
3	To Bus	7	8	9	15	29
	ATC (MW) CPFLOW/RPF	**An infeasible base case (thermal limits)**				
ATC Expected values from bus 29 to other buses (MW)						
	From Bus	29	29	29	29	29
4	To Bus	7	8	9	15	23
	ATC (MW) CPFLOW/RPF	869.05	396.79	619.72	411.37	436.01

Table 6. ATC expected values among candidate PQ buses in Area 3 of Nigeria Grid

ATC Expected values from bus 5 to other buses (MW)				
S/NO	From Bus	5	5	5
	To Bus	2	11	24
1	ATC (MW) CPFLOW/RPF	747.18	243.90	801.71
ATC Expected values from bus 11 to other buses (MW)				
	From Bus	11	11	11
2	To Bus	2	5	24
	ATC (MW) CPFLOW/RPF	497.63	498.52	500.34

Table 7. ATC expected values among candidate PQ buses in Area 4 of Nigeria Grid

ATC Expected values from bus 6 to other buses (MW)				
S/NO	From Bus	6	6	6
1	To Bus	17	19	22
	ATC (MW) CPFLOW/RPF	400.3	435.3	440.5
ATC Expected values from bus 17 to other buses (MW)				
	From Bus	17	17	17
2	To Bus	6	19	22
	ATC (MW) CPFLOW/RPF	604	388.6	399.2
ATC Expected values from bus 19 to other buses (MW)				
	From Bus	19	19	19
3	To Bus	6	17	22
	ATC (MW) CPFLOW/RPF	372.8	166.8	847.1

4.1.1 Area One Location

Figure 5 shows the ATC expected values among candidate buses in Area one of Nigerian grid. As depicted in Figure 5, bus 4, bus 10 and bus 32 reach higher ATC expected values hence these buses are suitable for siting new generator as they tend to provide more economic benefit.

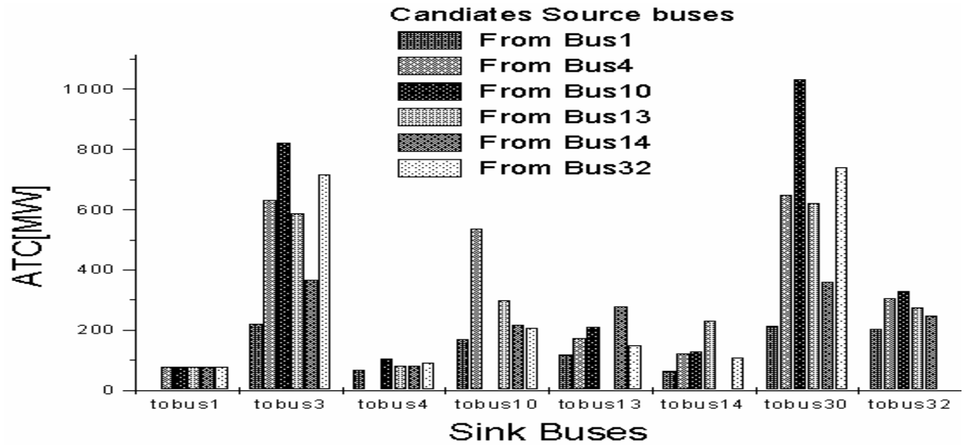

Figure 5. Comparison of ATC expected values among candidate buses in Area one of Nigerian grid.

4.1.2 Area Two Location

Among the candidate buses in Area two, bus 8 and bus 29 reach higher ATC expected values. These buses are therefore considered suitable for siting new generators as depicted in Figure 6.

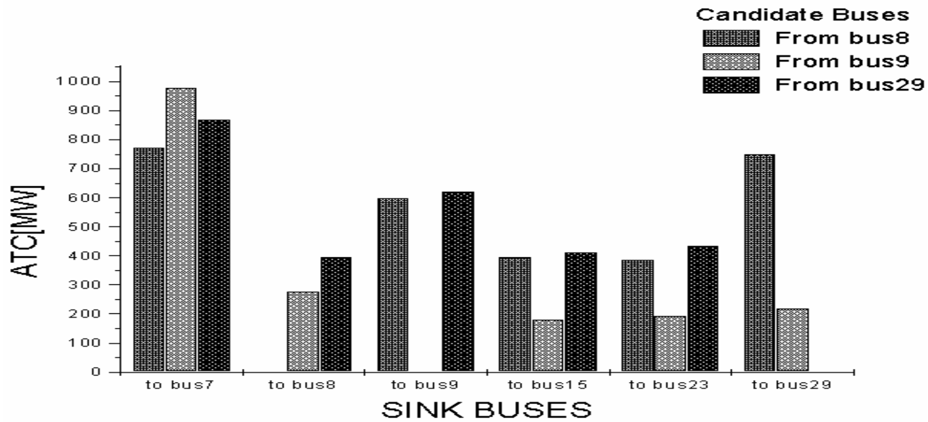

Figure 6. Comparison of ATC expected values among candidate buses in Area Two of Nigerian grid.

4.1.3 Area Three Location

Two candidate buses in Area three of Nigerian grid are considered, bus 5 and bus 11. Figure 7 shows the ATC distribution from buses 5 and 11 to other PQ buses in Area three. From the figure bus 5 is considered best for siting new generation resource since bus 5 reach higher ATC values to buses 2 and 24 when compared with bus 11.

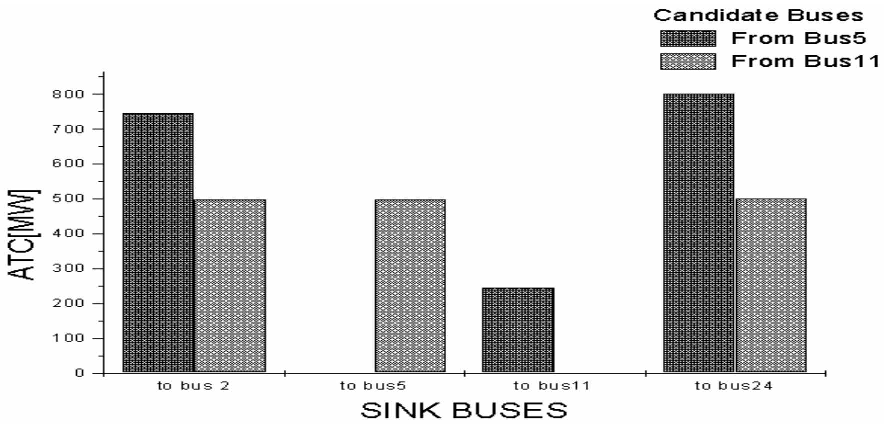

Figure 7. Comparison of ATC expected values among candidate buses in Area Three of Nigerian grid.

4.1.4 Area Four Location

In Area four, three candidate buses are viable: buses 6, 17 and 19. Figure 8 shows the ATC expected values from candidate buses to other PQ buses in Area Four of Nigerian grid. In the case of Area four, it is observed that ATC level as index for optimal siting of generators is not effective. As depicted in Figure 8, it is difficult to clearly identify a suitable candidate bus for optimal location. However, from the figure, buses 6 and 17 seem suitable.

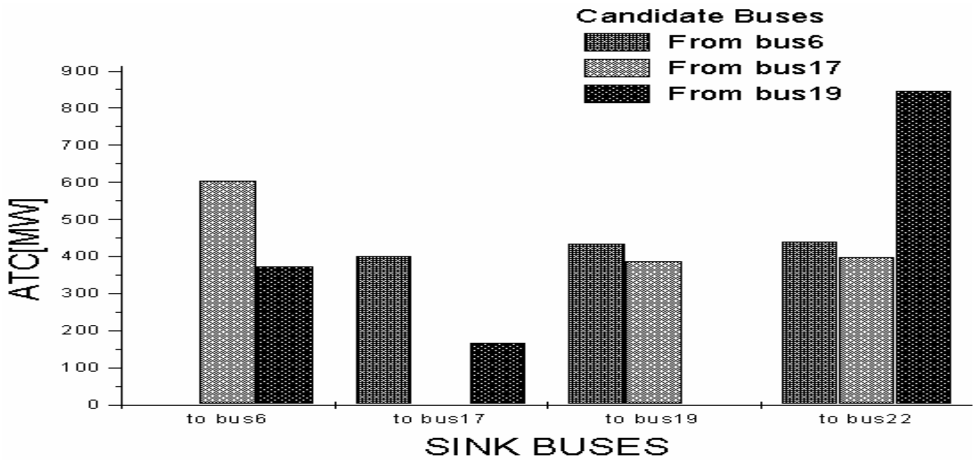

Figure 8. Comparison of ATC expected values among candidate buses in Area Four of Nigerian grid.

4.2 Genetic Algorithm (GA) for Real Power Loss Minimization.

GA program written in MATLAB environment is used to optimally find the bus with least real power loss. Within a given area of the Nigerian grid, candidate bus with the least real power loss and satisfying equation (4) and (5) is considered the most suitable bus. Figure 9 shows the fitness function value of candidate buses while Figure 10 gives the bus loss ratio for all candidate buses of the Nigerian grid. From these figures, the most suitable buses for each area was identified and tabulated in Table 8.

While ATC level index has some difficulty in identifying the most suitable bus, GA method gives clear information as to the optimal bus most suitable for siting the generator.

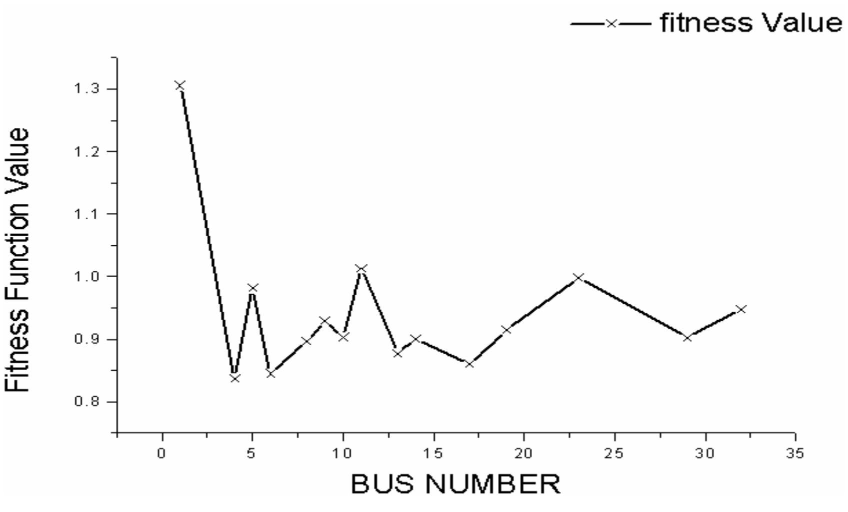

Figure 9. Fitness function value of candidate buses of Nigerian grid

Table 8. Comparison between ATC level Index and GA method for Optimal Siting of new Generator.

		Suitable Buses	
Area(s)	Candidate Buses	ATC Level Index	GA Loss Ratio Method
Area 1	1,4,10,13,14 and 32	4,10 and 32	4
Area 2	8,9 and 29	8 and 29	8
Area 3	5 and 11	5	5
Area 4	6,17 and 19	6 and 17	6

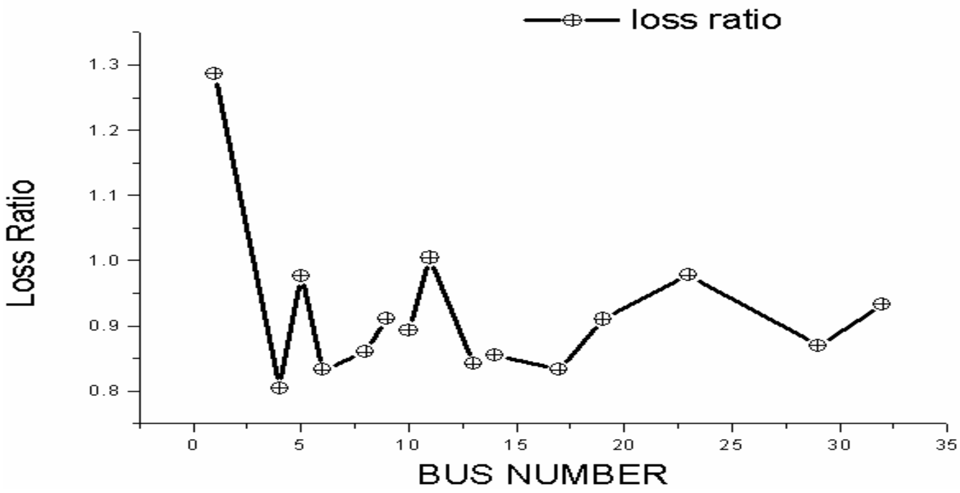

Figure 10. Losses ratio of candidate buses of Nigerian grid

From Figure 9 and Figure 10, bus 4 is the most suitable candidate of all candidate buses considered in the Nigerian grid. Figure 11 shows a comparison of the grid voltage profile before and after the location of new generator at bus 4.

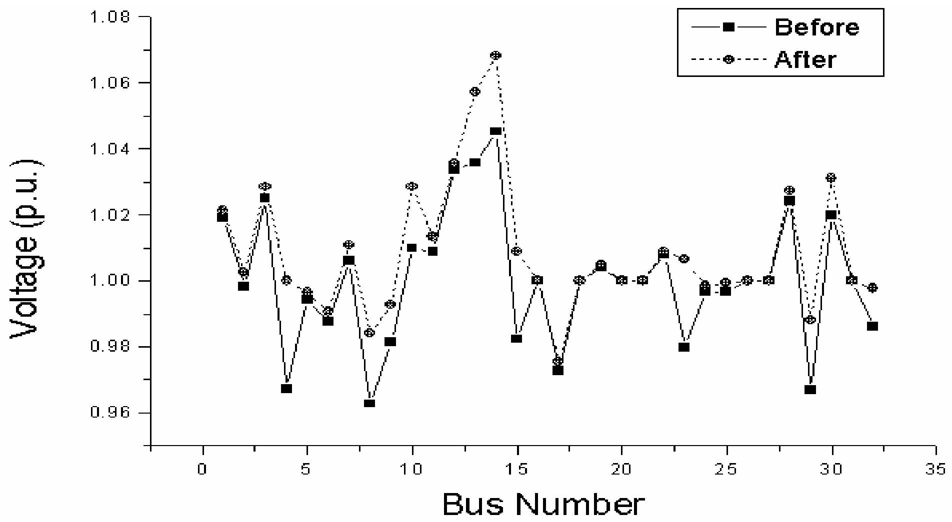

Figure 11. Voltage profile before and after location of generator at bus four

Figure 11 shows a slight improvement in the voltage profile of the Nigerian power grid when a new generator is located at bus 4. This demonstrate that the use of genetic algorithm for real power loss minimization is a better technique for optimal generator siting when compared with ATC level index. It is also observed that all bus voltages lie within specified range (0.9p.u. to 1.1p.u.).

5. Conclusion

This paper has discussed the index with which to estimate the position of the generation source, but with limitation of determining the optimal point for generator siting. By heuristic optimization considered, optimal generator siting was achieved through real power loss minimization, thus enhancing the voltage profile and equitable distribution of power on the entire Nigerian power grid. The comparative performance of the GA written and implemented in MATLAB environment gives this technique prominent use in determining the optimal location of the generation sources.

References

[1] Yuan-Kang, W. (2007). A novel algorithm for ATC calculations and applications in deregulated electricity markets. Electrical Power and Energy Systems , 810-821.

[2] Hamound, G., & Bradley, I. (2004). Assessment of Transmission Congestion Cost and Locational Marginal Pricing in a Competive Electricity Market. IEEE Transaction on Power System, Vol. 19, No. 2 , 769-775.

[3] Satish, K., B.B.R, S., Barjeev, T., & Vishal, K. (2011). Optimal Placement of Distributed Generation in Distribution Networks. International Journal of Engineering, Science and Technology. Vol. 3, No. 3 , 47-55.

[4] Amanifar, O., & M.E. Hamedani, G. (2011). Optimal Distributed Generation Placement and Sizing for Loss and THD Reduction and Voltage Profile Improvement in Distribution Systems Using Particle Swarm Optimization and Sensitivity Analysis. "Intenational Journal on Technical and Physical Problems of Engineering" (IJTPE) , 47-53.

[5] Mohammad, F. S., & Morteza, S. (2012). Applying BCO Algorithm to Solve Optimal DG Placement and Sizing Problem. Electrical and Electrical Engineering 2(2), DOI: 10.5923/j eee.20120202.06 , 31-37.

[6] Kotb, M., Shebl, K., El Khazendar, M., & El Husseiny, A. (2010). Genetic Algorithm for Optimal Siting and Sizing of Distributed Generation. 14th International Middle East Power Systems Conference (MEPCON), (pp. 433-440). Cairo University, Egypt.

[7] S. Chandrashekhar, R., Prasad, P., & A. Jaya, L. (2012). Optimal Number and Location of DGs to Improve Power Quality of Distributed Systems Using Particle Swarm Optimization. International Journal of Engineering Research and Applications (IJERA). Vol. 2, Isssue 3 , 3077-3082.

[8] Abbagana, M., Bakare, G., & Mustapha, I. (2011). Optimal Placement and Sizing of A Distributed Generation in A Power Distribution System Using Differential Evolution. 1st International Technolog. Education and Environment Conference (c) Afreical Society for Scientific Research (ASSR), (pp. 536-549).

[9] Arash, A., Farzad, M., Seyed, J., Shenava, S., & Aref, J. (2005). Optimal Sizing and Siting in Radial Standard System Using PSO. American Journal of Scientific Research , 50-58.

[10] Razazadehl, A., Sedighizadehl, M., & Alavian, A. (2009). Optimal sizing and Siting of Distributed Generation for Power System Transient Stability Ehancement Using Genetic Algorithm. IACSIT International Journal of Computer Theory and Engineering, Vol. 1, No. 5 , 387-390.

[11] Mohammad, S. M., & Soodabeh, S. (2011). Optimum Allocation of Distributed Generations Based on Evolutionary Programming for Loss Reduction and Voltage Profilr Correction. International Journal of Computer Science & Technology , 7-11.

[12] Noradin, G., Aref, J., & Rasoul, G. (2012). Optimum Allocation of Distributed Generation Based on Multi Objective Function with Genetic Algorithm. Journal of Basic and Applied Scientic Research , 185-191.

[13] Eseosa, O., & Odiase, F. O. (2012). Efficiency Improvement of Nigeria 330kV Network Using Flexible Alternating Current Transmission Systems (FACTS) Devices. International Journal of Advances in Engineering & Technology, Vol. 4, Issue 1 , 26-41.

[14] Labo, H. S. (2010). Investors Forum For The Privatisation Of PHCN Successor Companies. Abuja: Transmission Company of Nigeria.

[15] Venkataramana, A., & Colin, C. (1992). The Continuation Power Flow: A Tool for Steady State Voltgae Stability Analysis. IEEE Transactions Power System , 416-423.

[16] Sadiq, A. A. & Nwohu, M. N. (2013). Evaluation of Inter-Area Available Transfer Capability of Nigeria 330KV Network. International Journal of Engineering and Technology Vol. 3 No. 2.

[17] Ambafi, J. G. (2012). "Performance Evaluation of PSS and STATCOM on Oscillation damping: A case Study of the North-Central Nigeria 330KV Network Grid System, Lambert Academic Publishing, Germany. pp. 31-32