Analysis of Ayyanarthu Wind Farm with and without Battery Energy Storage System

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Abstract: This paper deals with the battery energy storage system is used in Ayyanarthu wind farm which analysing the variation in electrical parameters like voltage level, per unit value and power value should not vary even the battery energy storage system is applied in the windfarm and battery integrated with the windfarm can reduce the variability especially under the peak load conditions and also reduce the power quality problems, it can analyse through the simulation. DigSilent power factory tool software is used to design and analysis the windfarm the real data in windfarm for 24 hours. Battery energy storage system (BESS) is used to store the excess power because the wind is not constant, it will vary with time and natural climatic changes so that can store the power when the generation is high and the stored power can used when the power demand is high because now a days the population is high so the consumption of power is increasing and inject the surplus power to grid. This paper also highlights the need of storing power in order to strengthen the power and voltage levels. BESS further helps main three challenges i.e. smoothing the voltage levels, capacity firming and time shifting thus the battery energy storage system regulates the active power in a modern day grid.

Keywords: Ayyanarthu wind farm, battery, Energy storage system(ESS), Digsilent tool, voltage level, power, BESS.

I. INTRODUCTION

Now a days electrical power demand is increasing day by day, In order to meet the increasing in power demand, the world is moving towards the renewable energy sources like Wind, solar etc where the renewable energy sources are non-polluting and it is not creating any create any harm to environment. In those renewable sources wind place a vital role which is directly generating from wind and that generating power is AC therefore it does not require any power converters so cost of the devices is decreased. If there is any voltage swell or sag we are in need of power quality devices[3][4][5].This paper concentrate on energy storage system because the wind is not constant, it varies with the climatic changes to maintain its constant power [1][2]and also improve the sinusoidal waveforms[6], therefore when the power is generating more than demand we can store through the energy storage system and can use when the power demand is high. Battery energy storage technique in Ayyanarthu wind farm is new and that can analysed only with DIgsilent software when the demand and power generation is equal there will not be any power storage occur, only if the power generation is greater than the demand the power is stored in the form of DC in battery. This paper have been explained the integrated of voltage level in all the bus terminals[7].In future the supercapacitor and compressed air storage can be used for large scale wind power plant to store the power[8][9][10]the power is stored in the type of charging and discharging the power in the capacitor.

II. LAYOUT OF NEPC

NEPC layout is the part of Ayyanarthu wind farm it consist of 23 wind generator with different KW rating, it consist of(1*600kw), (9*200kw), (12*250kw).These 23 generators are connected in 11kv feeder and then it is stepped up using the step up transformer into 110 KV to the grid and the reactance value of transmission line must match with the grid.

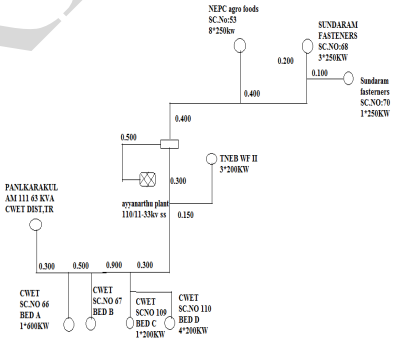


Fig 1.layout of NEPC

2.1 Single line diagram of NEPC layout

The single line diagram consists of 23 wind turbines. Each turbine connected with the transformer and the feeder range of 11kv and the main grid has constant voltage of 110 KV, there are 85 bus including the transmission lines and the transformers. Totally the windfarm consist of 23 wind turbines,23 transformers and 85 buses and those parameters are connected through the transmission line which has the rated capacity of 11 KV, it should be raised to 110KV to the grid.

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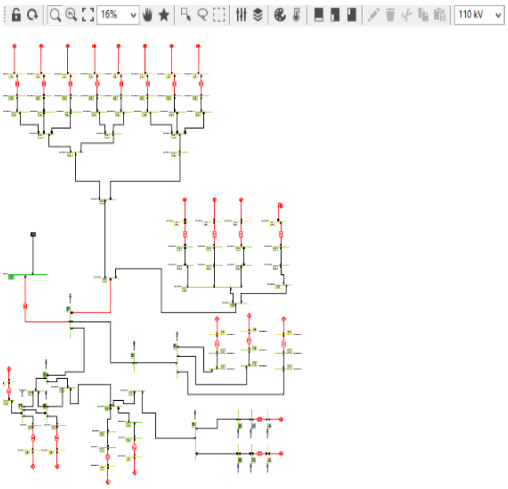


Fig 2: Single line diagram of NEPC layout

2.2 Load flow analysis of NEPC layout

Load flow analysis of NEPC layout which mainly focusing for analysing the voltage that should be equal with the bus voltage value.If the voltage level are not same with the bus voltage we need include the FACTS compensation devices.This fig 3 shows the load flow analysis of wind turbine which has the voltage of 0.4kv and it raised to the 11kv with the step up transformers and the 11kv flows throughout the transmission line which has the rated capacity is 11kv and the transformer is connected to the grid which has the capacity of 110/11kv.

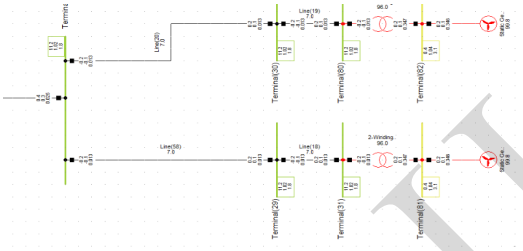


Fig 3: load flow analysis of NEPC layout

2.3 Layout of Ayyanarthu Plant

Ayyanarthu layout consist of 27 wind turbines which is rated as (1*250KW) , (23*200KW) , (3*225KW) then the total output is 5.525MW.The wind turbines are connected in feeder which has the rated capacity is 11kv and it raised into 110kv at the distribution side.

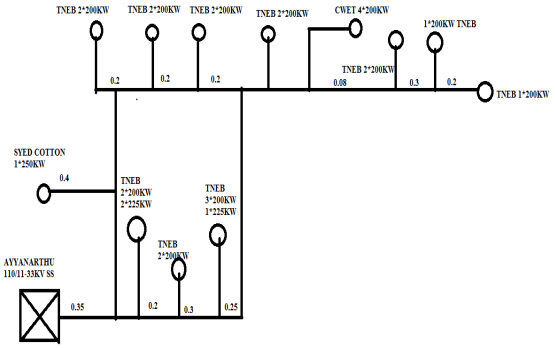


Fig 4:Ayyanarthu layout

2.4 Single line diagram of ayyanaruthu layout

The single line diagram consist of 23 wind turbines with the transformers are connected with turbine and the transmission lines are connected between the bus which has the value of 11kv and the main grid consist the voltage value of 110kv.

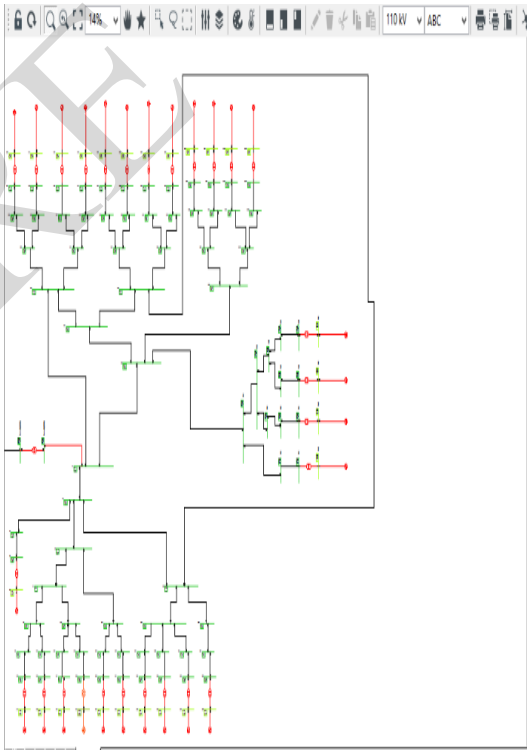


Fig 5:single line diagram of ayyanaruthu layout

2.5 Analysing the power

Ayyanarthu wind farm layout has analysed with the help of single line diagram in Digsilent software. Here the voltage may get increased or decreased by using the FACTS controller devices we can control the Sag and Swell.

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NEPC power rating

WIND TURBINE GENERATOR				TWO WINDING TRANSFORMER			
SL.NO	P(MW)	Q(MVAR)	S(MVA)	SL.NO	S(MVA)	HV(KV)	LV(KV)
G1	0.2	0.149	0.25	T1	0.25	11	0.4
G2	0.6	0.449	0.75	T2	0.75	11	0.4
G3	0.2	0.149	0.25	T3	0.25	11	0.4
G4	0.2	0.149	0.25	T4	0.25	11	0.4
G5	0.2	0.149	0.25	T5	0.25	11	0.4
G6	0.2	0.149	0.25	T6	0.25	11	0.4
G7	0.2	0.149	0.25	T7	0.25	11	0.4
G8	0.2	0.149	0.25	T8	0.25	11	0.4
G9	0.2	0.149	0.25	T9	0.25	11	0.4
G10	0.2	0.149	0.25	T10	0.25	11	0.4
G11	0.25	0.187	0.312	T11	0.312	11	0.4
G12	0.25	0.187	0.312	T12	0.312	11	0.4
G13	0.25	0.187	0.312	T13	0.312	11	0.4
G14	0.25	0.187	0.312	T14	0.312	11	0.4
G15	0.25	0.187	0.312	T15	0.312	11	0.4
G16	0.25	0.187	0.312	T16	0.312	11	0.4
G17	0.25	0.187	0.312	T17	0.312	11	0.4
G18	0.25	0.187	0.312	T18	0.312	11	0.4
G19	0.25	0.187	0.312	T19	0.312	11	0.4
G20	0.25	0.187	0.312	T20	0.312	11	0.4
G21	0.25	0.187	0.312	T21	0.312	11	0.4
G22	0.25	0.187	0.312	T22	0.312	11	0.4
				T23	5	110	11

Fig 6:NEPC power value

The above tabular column explains the power in each turbine and transformer. NEPC layout has 22 wind turbine generator and 23 transformers .The simulation is done with the Guass seidal method therefore it gone through the three iterations the power and voltage is same in all the iterations therefore the output is accurate.

2.6 Ayyanarthu power rating

In Ayyarathu power plant consist of 27 wind turbines therefore it has more analysis to obtain the accurate power rating. The rating of each turbine generator is (1*250Kw), (3*225Kw), (23*200Kw) then the total output power 6.906Mw.It has the step up transformer to raised up to 11/0.4 Kv and thetransformer are used in grid side i.e 110/11-33Kv.

WIND TURBINE GENERATOR				WIND TURBINE GENERATOR				TRASNFORMER				TRASNFORMER			
SL.NO	P(MW)	Q(MVAR)	S(MVA)	SL.NO	P(MW)	Q(MVAR)	S(MVA)	SL.NO	S(MVA)	HV(KV)	LV(KV)	SL.NO	S(MVA)	HV(KV)	LV(KV)
G1	0.25	0.187	0.312	G24	0.2	0.149	0.25	T1	0.312	11	0.4	T24	0.25	11	0.4
G2	0.2	0.149	0.25	G25	0.2	0.149	0.25	T2	0.312	11	0.4	T25	0.25	11	0.4
G3	0.2	0.149	0.25	G26	0.2	0.149	0.25	T3	0.312	11	0.4	T26	0.25	11	0.4
G4	0.225	0.168	0.281	G27	0.2	0.149	0.25	T4	0.312	11	0.4	T27	0.25	11	0.4
G5	0.225	0.168	0.281					T5	0.312	11	0.4	T28	6.906	110	11
G6	0.2	0.149	0.25					T6	0.25	11	0.4				
G7	0.2	0.149	0.25					T7	0.25	11	0.4				
G8	0.2	0.149	0.25					T8	0.25	11	0.4				
G9	0.2	0.149	0.25					T9	0.25	11	0.4				
G10	0.2	0.149	0.25					T10	0.25	11	0.4				
G11	0.225	0.168	0.281					T11	0.281	11	0.4				
G12	0.2	0.149	0.25					T12	0.29	11	0.4				
G13	0.2	0.149	0.25					T13	0.25	11	0.4				
G14	0.2	0.149	0.25					T14	0.25	11	0.4				
G15	0.2	0.149	0.25					T15	0.25	11	0.4				
G16	0.2	0.149	0.25					T16	0.25	11	0.4				
G17	0.2	0.149	0.25					T17	0.25	11	0.4				
G18	0.2	0.149	0.25					T18	0.25	11	0.4				
G19	0.2	0.149	0.25					T19	0.25	11	0.4				
G20	0.2	0.149	0.25					T20	0.25	11	0.4				
G21	0.2	0.149	0.25					T21	0.25	11	0.4				
G22	0.2	0.149	0.25					T22	0.25	11	0.4				
G23	0.2	0.149	0.25					T23	0.25	11	0.4				

Fig 7 Power tabular column of ayyarathu

III. ANALYSING OF VOLATGE WITHOUT BATTERY

In this layout analysing the bus voltage at different terminal .All other parameters are connected through the bus bar, Overall voltage rating is 11KV and once it connected to step up transformer the voltage raised to 110KV.Inthis layout 85 bus bar are used therefore it required the voltage values, reactive power and real power. If there is any problem in simulation we need to check all the voltages that we have applied in bus bar therefore while the values are applying to the bus bar need more concentration and the execution will take place, the simulation is carried out through the guass seidal method it will take atleast three iterations to get the accurate voltage values.

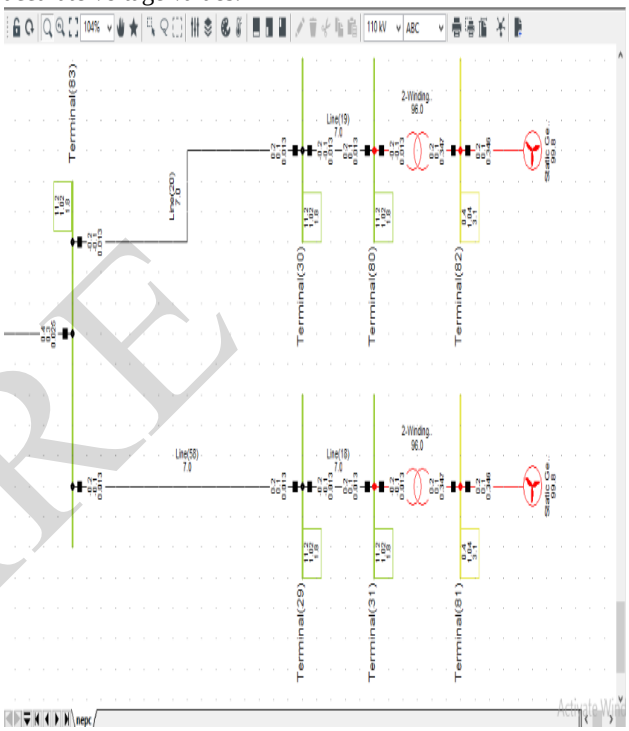


Fig 8: Load flow voltage values

3.1 Terminal voltage of NEPC layout without using battery

NEPC consist of 85 terminal voltage buses which has the same voltage and the phase angle ,it will differ with the transformer voltage levels and the per unit will be 0.02 and 0.04 .The corresponding voltage level should be compare with the terminal voltage once the battery is connected to the grid.

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TERMINAL VOLTAGE WITHOUT BATTERY

SL.NO	UI (KV)	u (p.u)	phiu(deg)	SL.NO	UI (KV)	u (p.u)	phiu(deg)	SL.NO	UI (KV)	u (p.u)	phiu(deg)	SL.NO	UI (KV)	u (p.u)	phiu(deg)
T1	0.4	1.04	3.1	T23	0.4	1.04	3.1	T45	11.2	1.02	1.8	T67	11.2	1.02	1.8
T2	11.2	1.02	1.8	T24	11.2	1.02	1.8	T46	11.2	1.02	1.8	T68	11.2	1.02	1.8
T3	1.2	1.02	1.8	T25	11.2	1.02	1.8	T47	0.4	1.04	3.1	T69	11.2	1.02	1.8
T4	11.2	1.02	1.8	T26	0.4	1.04	3.1	T48	11.2	1.02	1.8	T70	0.4	1.04	3.1
T5	0.4	1.04	3.1	T27	11.2	1.02	1.8	T49	11.2	1.02	1.8	T71	11.2	1.02	1.8
T6	11.2	1.02	1.8	T28	11.2	1.02	1.8	T50	0.4	1.04	3.1	T72	11.2	1.02	1.8
T7	0.4	1.04	3.1	T29	11.2	1.02	1.8	T51	11.2	1.02	1.8	T73	0.4	1.04	3.1
T8	11.2	1.02	1.8	T30	11.2	1.02	1.8	T52	11.2	1.02	1.8	T74	11.2	1.02	1.8
T9	11.2	1.02	1.8	T31	0.4	1.04	3.1	T53	11.2	1.02	1.8	T75	11.2	1.02	1.8
T10	11.2	1.02	1.8	T32	11.2	1.02	1.8	T54	0.4	1.04	3.1	T76	11.2	1.02	1.8
T11	11.2	1.02	1.8	T33	11.2	1.02	1.8	T55	11.2	1.02	1.8	T77	11.2	1.02	1.8
T12	11.2	1.02	1.8	T34	0.4	1.04	3.1	T56	11.2	1.02	1.8	T78	0.4	1.04	3.1
T13	11.2	1.02	1.8	T35	11.2	1.02	1.8	T57	11.2	1.02	1.8	T79	11.2	1.02	1.8
T14	11.2	1.02	1.8	T36	11.2	1.02	1.8	T58	11.2	1.02	1.8	T80	11.2	1.02	1.8
T15	11.2	1.02	1.8	T37	0.4	1.04	3.1	T59	11.2	1.02	1.8	T81	0.4	1.04	3.1
T16	0.4	1.04	3.1	T38	11.2	1.02	1.8	T60	0.4	1.04	3.1	T82	11.2	1.02	1.8
T17	11.2	1.02	1.8	T39	11.2	1.02	1.8	T61	11.2	1.02	1.8	T83	11.2	1.02	1.8
T18	11.2	1.02	1.8	T40	11.2	1.02	1.8	T62	11.2	1.02	1.8	T84	0.4	1.04	3.1
T19	0.4	1.04	3.1	T41	11.2	1.02	1.8	T63	0.4	1.04	3.1	T85	110	1	0
T20	11.2	1.02	1.8	T42	11.2	1.02	1.8	T64	11.2	1.02	1.8				
T21	11.2	1.02	1.8	T43	11.2	1.02	1.8	T65	11.2	1.02	1.8				
T22	11.2	1.02	1.8	T44	0.4	1.04	3.1	T66	0.4	1.04	3.1				

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Fig 9:NEPC terminal voltage without battery

TERMINAL VOLTAGE WITH BATTERY

SL.NO	UI (KV)	u (p.u)	phiu(deg)	SL.NO	UI (KV)	u (p.u)	phiu(deg)	SL.NO	UI (KV)	u (p.u)	phiu(deg)	SL.NO	UI (KV)	u (p.u)	phiu(deg)
T1	0.4	1.04	3.1	T23	0.4	1.04	3.1	T45	11.2	1.02	1.7	T67	11.2	1.02	1.7
T2	11.2	1.02	1.7	T24	11.2	1.02	1.7	T46	11.2	1.02	1.7	T68	11.2	1.02	1.7
T3	1.2	1.02	1.7	T25	11.2	1.02	1.7	T47	0.4	1.04	3.1	T69	11.2	1.02	1.7
T4	11.2	1.02	1.7	T26	0.4	1.04	3.1	T48	11.2	1.02	1.7	T70	0.4	1.04	3.1
T5	0.4	1.04	3.1	T27	11.2	1.02	1.7	T49	11.2	1.02	1.7	T71	11.2	1.02	1.7
T6	11.2	1.02	1.7	T28	11.2	1.02	1.7	T50	0.4	1.04	3.1	T72	11.2	1.02	1.7
T7	0.4	1.04	3.1	T29	11.2	1.02	1.7	T51	11.2	1.02	1.7	T73	0.4	1.04	3.1
T8	11.2	1.02	1.7	T30	11.2	1.02	1.7	T52	11.2	1.02	1.7	T74	11.2	1.02	1.7
T9	11.2	1.02	1.7	T31	0.4	1.04	3.1	T53	11.2	1.02	1.7	T75	11.2	1.02	1.7
T10	11.2	1.02	1.7	T32	11.2	1.02	1.7	T54	0.4	1.04	3.1	T76	11.2	1.02	1.7
T11	11.2	1.02	1.7	T33	11.2	1.02	1.7	T55	11.2	1.02	1.7	T77	11.2	1.02	1.7
T12	11.2	1.02	1.7	T34	0.4	1.04	3.1	T56	11.2	1.02	1.7	T78	0.4	1.04	3.1
T13	11.2	1.02	1.7	T35	11.2	1.02	1.7	T57	11.2	1.02	1.7	T79	11.2	1.02	1.7
T14	11.2	1.02	1.7	T36	11.2	1.02	1.7	T58	11.2	1.02	1.7	T80	11.2	1.02	1.7
T15	11.2	1.02	1.7	T37	0.4	1.04	3.1	T59	11.2	1.02	1.7	T81	0.4	1.04	3.1
T16	0.4	1.04	3.1	T38	11.2	1.02	1.7	T60	0.4	1.04	3.1	T82	11.2	1.02	1.7
T17	11.2	1.02	1.7	T39	11.2	1.02	1.7	T61	11.2	1.02	1.7	T83	11.2	1.02	1.7
T18	11.2	1.02	1.7	T40	11.2	1.02	1.7	T62	11.2	1.02	1.7	T84	0.4	1.04	3.1
T19	0.4	1.04	3.1	T41	11.2	1.02	1.7	T63	0.4	1.04	3.1	T85	110	1	0
T20	11.2	1.02	1.7	T42	11.2	1.02	1.7	T64	11.2	1.02	1.7				
T21	11.2	1.02	1.7	T43	11.2	1.02	1.7	T65	11.2	1.02	1.7				
T22	11.2	1.02	1.7	T44	0.4	1.04	3.1	T66	0.4	1.04	3.1				

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Fig 10:NEPC battery voltage

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3.2 Analysing of voltage with battery in nepc layout

The battery is used as energy storage device and it connected to the grid, therefore we need to compare the battery voltage with the terminal voltage. If both the terminal voltage before connecting the battery should be same as battery connected to the system. The simulation results will be almost equal and there will be a less variation and that will not be affecting the distribution side.

3.3 Ayyanaruthu layout terminal voltage without battery

1	TERMINAL VOLTAGE WITHOUT BATTERY				TERMINAL VOLTAGE WITHOUT BATTERY				TERMINAL VOLTAGE WITHOUT BATTERY				TERMINAL VOLTAGE WITHOUT BATTERY				TERMINAL VOLTAGE WITHOUT BATTERY			
2	SL.NO	UI (KV)	u (p.u)	phiu(deg)	SL.NO	UI (KV)	u (p.u)	phiu(deg)	SL.NO	UI (KV)	u (p.u)	phiu(deg)	SL.NO	UI (KV)	u (p.u)	phiu(deg)	SL.NO	UI (KV)	u (p.u)	phiu(deg)
3	T1	11.2	1.02	1.4	T24	11.2	1.02	1.4	T47	11.2	1.02	1.4	T70	11.2	1.02	1.4	T93	11.2	1.02	1.4
4	T2	11.2	1.02	1.4	T25	0.4	1.03	2.7	T48	11.2	1.02	1.4	T71	0.4	1.03	2.7	T94	11.2	1.02	1.4
5	T3	11.2	1.02	1.4	T26	11.2	1.02	1.4	T49	11.2	1.02	1.4	T72	11.2	1.02	1.4	T95	11.2	1.02	1.4
6	T4	11.2	1.02	1.4	T27	11.2	1.02	1.4	T50	11.2	1.02	1.4	T73	11.2	1.02	1.4	T96	0.4	1.03	2.7
7	T5	0.4	1.03	2.7	T28	0.4	1.03	2.7	T51	11.2	1.02	1.4	T74	11.2	1.02	1.4	T97	11.2	1.02	1.4
8	T6	11.2	1.02	1.4	T29	0.4	1.03	2.7	T52	0.4	1.03	2.7	T75	0.4	1.03	2.7	T98	11.2	1.02	1.4
9	T7	11.2	1.02	1.4	T30	11.2	1.02	1.4	T53	11.2	1.02	1.4	T76	11.2	1.02	1.4	T99	0.4	1.03	2.7
10	T8	11.2	1.02	1.4	T31	11.2	1.02	1.4	T54	11.2	1.02	1.4	T77	11.2	1.02	1.4	T100	11.2	1.02	1.4
11	T9	11.2	1.02	1.4	T32	11.2	1.02	1.4	T55	11.2	1.02	1.4	T78	0.4	1.03	2.7	T101	11.2	1.02	1.4
12	T10	11.2	1.02	1.4	T33	0.4	1.03	2.7	T56	0.4	1.03	2.7	T79	11.2	1.02	1.4	T102	11.2	1.02	1.4
13	T11	0.4	1.03	2.7	T34	11.2	1.02	1.4	T57	11.2	1.02	1.4	T80	11.2	1.02	1.4	T103	0.4	1.03	2.7
14	T12	11.2	1.02	1.4	T35	11.2	1.02	1.4	T58	11.2	1.02	1.4	T81	11.2	1.02	1.4	T104	11.2	1.02	1.4
15	T13	11.2	1.02	1.4	T36	0.4	1.03	2.7	T59	0.4	1.03	2.7	T82	0.4	1.03	2.7	T105	11.2	1.02	1.4
16	T14	0.4	1.03	2.7	T37	11.2	1.02	1.4	T60	11.2	1.02	1.4	T83	11.2	1.02	1.4	T106	0.4	1.03	2.7
17	T15	11.2	1.02	1.4	T38	11.2	1.02	1.4	T61	11.2	1.02	1.4	T84	11.2	1.02	1.4	T107	110	1	0
18	T16	11.2	1.02	1.4	T39	0.4	1.03	2.8	T62	11.2	1.02	1.4	T85	0.4	1.03	2.7	T108	11.2	1.02	1.4
19	T17	11.2	1.02	1.4	T40	11.2	1.02	1.4	T63	11.2	1.02	1.4	T86	11.2	1.02	1.4				
20	T18	0.4	1.03	2.7	T41	11.2	1.02	1.4	T64	11.2	1.02	1.4	T87	11.2	1.02	1.4				
21	T19	11.2	1.02	1.4	T42	11.2	1.02	1.4	T65	11.2	1.02	1.4	T88	11.2	1.02	1.4				
22	T20	11.2	1.02	1.4	T43	0.4	1.03	2.7	T66	11.2	1.02	1.4	T89	0.4	1.03	2.7				
23	T21	0.4	1.03	2.7	T44	11.2	1.02	1.4	T67	11.2	1.02	1.4	T90	11.2	1.02	1.4				
24	T22	11.2	1.02	1.4	T45	11.2	1.02	1.4	T68	0.4	1.03	2.7	T91	11.2	1.02	1.4				
25	T23	11.2	1.02	1.4	T46	11.2	1.02	1.4	T69	11.2	1.02	1.4	T92	0.4	1.03	2.7				

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Fig 11: Ayyanarathu terminal voltage without battery

Ayyanarathu layout has 108 terminals i.e. busbar voltage, it has both step up and step down voltage levels is same with the terminal voltage . The phase angle will be differ to the voltage levels and per unit level will be slightly greater than the 1 but that will not be affect the system even the terminal voltage value is slightly greater than the input.. Here given input voltage is 0.4Kv and the busbar value has 11Kv therefore step up transformer is used again the grid voltage is 110Kv that will be distributed to the consumers and the industries so again need to step up the voltage.

3.4 Analysing of voltage with battery in ayyanaruthu plant

The battery is inserted as energy storage device in grid, therefore we need to compare the battery voltage with the terminal voltage. If both the terminal without battery and terminal voltage with battery is same then we can implement the energy storage techniques in real plant. The simulation results will be almost equal and there is somewhat very minute variation and that will not be affecting anyways to the system and the voltage at distribution side will be accurate.

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	TERMINAL VOLTAGE WITH BATTERY				TERMINAL VOLTAGE WITH BATTERY				TERMINAL VOLTAGE WITH BATTERY				TERMINAL VOLTAGE WITH BATTERY				TERMINAL VOLTAGE WITH BATTERY			
2	SL.NO	UI (KV)	u (p.u)	phiu(deg)	SL.NO	UI (KV)	u (p.u)	phiu(deg)	SL.NO	UI (KV)	u (p.u)	phiu(deg)	SL.NO	UI (KV)	u (p.u)	phiu(deg)	SL.NO	UI (KV)	u (p.u)	phiu(deg)
3	T1	11.2	1.02	1.5	T24	11.2	1.02	1.5	T47	11.2	1.02	1.5	T70	11.2	1.02	1.5	T93	11.2	1.02	1.5
4	T2	11.2	1.02	1.5	T25	0.4	1.03	2.7	T48	11.2	1.02	1.5	T71	0.4	1.03	2.7	T94	11.2	1.02	1.5
5	T3	11.2	1.02	1.5	T26	11.2	1.02	1.5	T49	11.2	1.02	1.5	T72	11.2	1.02	1.5	T95	11.2	1.02	1.5
6	T4	11.2	1.02	1.5	T27	11.2	1.02	1.5	T50	11.2	1.02	1.5	T73	11.2	1.02	1.5	T96	0.4	1.03	2.7
7	T5	0.4	1.03	2.7	T28	0.4	1.03	2.7	T51	11.2	1.02	1.5	T74	11.2	1.02	1.5	T97	11.2	1.02	1.5
8	T6	11.2	1.02	1.5	T29	0.4	1.03	2.7	T52	0.4	1.03	2.7	T75	0.4	1.03	2.7	T98	11.2	1.02	1.5
9	T7	11.2	1.02	1.5	T30	11.2	1.02	1.5	T53	11.2	1.02	1.5	T76	11.2	1.02	1.5	T99	0.4	1.03	2.7
10	T8	11.2	1.02	1.5	T31	11.2	1.02	1.5	T54	11.2	1.02	1.5	T77	11.2	1.02	1.5	T100	11.2	1.02	1.5
11	T9	11.2	1.02	1.5	T32	11.2	1.02	1.5	T55	11.2	1.02	1.5	T78	0.4	1.03	2.7	T101	11.2	1.02	1.5
12	T10	11.2	1.02	1.5	T33	0.4	1.03	2.7	T56	0.4	1.03	2.7	T79	11.2	1.02	1.5	T102	11.2	1.02	1.5
13	T11	0.4	1.03	2.7	T34	11.2	1.02	1.5	T57	11.2	1.02	1.5	T80	11.2	1.02	1.5	T103	0.4	1.03	2.7
14	T12	11.2	1.02	1.5	T35	11.2	1.02	1.5	T58	11.2	1.02	1.5	T81	11.2	1.02	1.5	T104	11.2	1.02	1.5
15	T13	11.2	1.02	1.5	T36	0.4	1.03	2.7	T59	0.4	1.03	2.7	T82	0.4	1.03	2.7	T105	11.2	1.02	1.5
16	T14	0.4	1.03	2.7	T37	11.2	1.02	1.5	T60	11.2	1.02	1.5	T83	11.2	1.02	1.5	T106	0.4	1.03	1.5
17	T15	11.2	1.02	1.5	T38	11.2	1.02	0.5	T61	11.2	1.02	1.5	T84	11.2	1.02	1.5	T107	110	1	0
18	T16	11.2	1.02	1.5	T39	0.4	1.03	2.8	T62	11.2	1.02	1.5	T85	0.4	1.03	2.7	T108	11.2	1.02	1.5
19	T17	11.2	1.02	1.5	T40	11.2	1.02	1.5	T63	11.2	1.02	1.5	T86	11.2	1.02	1.5				
20	T18	0.4	1.03	2.7	T41	11.2	1.02	1.5	T64	11.2	1.02	1.5	T87	11.2	1.02	1.5				
21	T19	11.2	1.02	1.5	T42	11.2	1.02	1.5	T65	11.2	1.02	1.5	T88	11.2	1.02	1.5				
22	T20	11.2	1.02	1.5	T43	0.4	1.03	2.7	T66	11.2	1.02	1.5	T89	0.4	1.03	2.7				
23	T21	0.4	1.03	2.7	T44	11.2	1.02	1.5	T67	11.2	1.02	1.5	T90	11.2	1.02	1.5				
24	T22	11.2	1.02	1.5	T45	11.2	1.02	1.5	T68	0.4	1.03	2.7	T91	11.2	1.02	1.5				
25	T23	11.2	1.02	1.5	T46	11.2	1.02	1.5	T69	11.2	1.02	1.5	T92	0.4	1.03	2.7				

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Fig 12: Ayyanarathu Battery Voltage

IV. CONCLUSION

The paper conclude that the voltage level are not increased or decreased in any of the feeder line after the battery is placed in the wind farm.the voltage will be same as the voltage given as input. This paper describes that wind farm with and without battery the voltage almost same and there is slightly the voltage value greater than the voltage without battery through the Digsilent software and the variation in voltage will not be affect the system, therefore it can be implemented in wind farm and we can save the excess power and it can be used for peak demand.

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