

Project: MINI-GRID (IMG) 6.45MWp/10MWh
Location: JAJI, KADUNA
Contract:
Engineer: A. ADEFEMI
Filename: AES RENEWABLES

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Electrical Transient Analyzer Program

Short-Circuit Analysis

IEC 60909 Standard

3-Phase Fault Currents

	Swing	V-Control	Load	Total			
Number of Buses:	1	0	89	90			
	XFMR2	XFMR3	Reactor	Line/Cable/ Busway	Impedance	Tie PD	Total
Number of Branches:	37	0	0	46	2	3	88
	Synchronous Generator	Power Grid	Synchronous Motor	Induction Machines	Lumped Load	Inverter	Total
Number of Machines:	0	1	1	0	0	44	46

System Frequency: 50.00
Unit System: Metric
Project Filename: AES RENEWABLES
Output Filename: C:\ETAP 2401\AES RENEWABLES\Worst-Case Device Duty Screening.S11S

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Adjustments

<u>Tolerance</u>	<u>Apply Adjustments</u>	<u>Individual /Global</u>	<u>Percent</u>
Transformer Impedance:	Yes	Individual	
Reactor Impedance:	Yes	Individual	
Overload Heater Resistance:	No		
Transmission Line Length:	No		
Cable / Busway Length:	No		
<u>Temperature Correction</u>	<u>Apply Adjustments</u>	<u>Individual /Global</u>	<u>Degree C</u>
Transmission Line Resistance:	Yes	Individual	
Cable / Busway Resistance:	Yes	Individual	

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Bus Input Data

Bus					Initial Voltage	
ID	Type	Nom. kV	Base kV	Sub-sys	%Mag.	Ang.
Bus2	Load	11.000	11.000	1	100.00	0.00
Bus3	Load	0.415	0.387	1	100.00	0.00
Bus8	Load	0.800	0.762	1	100.00	0.00
Bus9	Load	0.415	0.415	1	100.00	0.00
Bus10	Load	0.415	0.415	28	100.00	0.00
Bus15	SWNG	11.000	11.000	1	100.00	0.00
Bus26	Load	11.000	11.000	1	100.00	0.00
Bus27	Load	11.000	11.000	1	100.00	0.00
Bus28	Load	11.000	11.000	1	100.00	0.00
Bus29	Load	11.000	11.000	1	100.00	0.00
Bus30	Load	11.000	11.000	1	100.00	0.00
Bus32	Load	11.000	11.000	1	100.00	0.00
Bus34	Load	11.000	11.000	1	100.00	0.00
Bus35	Load	11.000	11.000	1	100.00	0.00
Bus36	Load	11.000	11.000	1	100.00	0.00
Bus37	Load	11.000	11.000	1	100.00	0.00
Bus38	Load	11.000	11.000	1	100.00	0.00
Bus39	Load	11.000	11.000	1	100.00	0.00
Bus40	Load	11.000	11.000	1	100.00	0.00
Bus41	Load	11.000	11.000	1	100.00	0.00
Bus42	Load	11.000	11.000	1	100.00	0.00
Bus43	Load	11.000	11.000	1	100.00	0.00
Bus45	Load	0.415	0.415	1	100.00	0.00
Bus46	Load	11.000	11.000	1	100.00	0.00
Bus47	Load	11.000	11.000	1	100.00	0.00
Bus48	Load	11.000	11.000	1	100.00	0.00
Bus49	Load	11.000	11.000	1	100.00	0.00
Bus50	Load	11.000	11.000	1	100.00	0.00
Bus51	Load	11.000	11.000	1	100.00	0.00
Bus52	Load	11.000	11.000	1	100.00	0.00
Bus54	Load	11.000	11.000	1	100.00	0.00
Bus55	Load	11.000	11.000	1	100.00	0.00
Bus56	Load	11.000	11.000	1	100.00	0.00
Bus57	Load	11.000	11.000	1	100.00	0.00
Bus59	Load	11.000	11.000	1	100.00	0.00
Bus60	Load	11.000	11.000	1	100.00	0.00
Bus61	Load	11.000	11.000	1	100.00	0.00
Bus62	Load	11.000	11.000	1	100.00	0.00
Bus63	Load	11.000	11.000	1	100.00	0.00
Bus64	Load	11.000	11.000	1	100.00	0.00
Bus65	Load	11.000	11.000	1	100.00	0.00

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Bus					Initial Voltage	
ID	Type	Nom. kV	Base kV	Sub-sys	%Mag.	Ang.
Bus66	Load	11.000	11.000	1	100.00	0.00
Bus67	Load	11.000	11.000	1	100.00	0.00
Bus68	Load	11.000	11.000	1	100.00	0.00
Bus70	Load	11.000	11.000	1	100.00	0.00
Bus72	Load	11.000	11.000	1	100.00	0.00
Bus73	Load	11.000	11.000	1	100.00	0.00
Bus74	Load	11.000	11.000	1	100.00	0.00
Bus75	Load	11.000	11.000	1	100.00	0.00
Bus76	Load	11.000	11.000	1	100.00	0.00
Bus77	Load	11.000	11.000	1	100.00	0.00
Bus78	Load	11.000	11.000	1	100.00	0.00
Bus79	Load	11.000	11.000	1	100.00	0.00
Bus80	Load	11.000	11.000	1	100.00	0.00
Bus81	Load	0.415	0.405	1	100.00	0.00
Bus82	Load	0.415	0.415	1	100.00	0.00
Bus83	Load	0.415	0.415	1	100.00	0.00
Bus84	Load	0.415	0.415	1	100.00	0.00
Bus85	Load	0.415	0.415	1	100.00	0.00
Bus86	Load	0.415	0.415	1	100.00	0.00
Bus87	Load	0.415	0.405	1	100.00	0.00
Bus88	Load	0.415	0.415	1	100.00	0.00
Bus89	Load	0.415	0.415	1	100.00	0.00
Bus90	Load	0.415	0.415	1	100.00	0.00
Bus91	Load	0.415	0.415	1	100.00	0.00
Bus92	Load	0.415	0.415	1	100.00	0.00
Bus93	Load	0.415	0.415	1	100.00	0.00
Bus94	Load	0.415	0.425	1	100.00	0.00
Bus95	Load	0.415	0.425	1	100.00	0.00
Bus96	Load	0.415	0.415	1	100.00	0.00
Bus97	Load	0.415	0.425	1	100.00	0.00
Bus98	Load	0.415	0.425	1	100.00	0.00
Bus99	Load	0.415	0.415	1	100.00	0.00
Bus100	Load	0.415	0.415	1	100.00	0.00
Bus101	Load	0.415	0.415	1	100.00	0.00
Bus102	Load	0.415	0.425	1	100.00	0.00
Bus103	Load	0.415	0.415	1	100.00	0.00
Bus104	Load	0.415	0.415	1	100.00	0.00
Bus105	Load	0.415	0.425	1	100.00	0.00
Bus106	Load	0.415	0.425	1	100.00	0.00
Bus107	Load	0.415	0.425	1	100.00	0.00
Bus108	Load	0.415	0.415	1	100.00	0.00
Bus109	Load	0.415	0.425	1	100.00	0.00
Bus110	Load	0.415	0.425	1	100.00	0.00

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Bus					Initial Voltage	
ID	Type	Nom. kV	Base kV	Sub-sys	%Mag.	Ang.
Bus111	Load	0.415	0.425	1	100.00	0.00
Bus112	Load	0.415	0.425	1	100.00	0.00
Bus113	Load	0.800	0.753	1	100.00	0.00
Bus114	Load	0.800	0.753	1	100.00	0.00
Bus115	Load	0.415	0.415	1	100.00	0.00
MV_BUS	Load	11.000	11.000	1	105.00	0.00

90 Buses Total

All voltages reported by ETAP are in % of bus Nominal kV.
Base kV values of buses are calculated and used internally by ETAP .

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Line/Cable/Busway Input Data

ohms or siemens/1000 m per Conductor (Cable) or per Phase (Line/Busway)									
Line/Cable/Busway		Length							
ID	Library	Size	Adj. (m)	% Tol.	#/Phase	T (°C)	R	X	Y
Cable3	11NALS1	500	5.0	0	1	75	0.07499	0.20061	0.0001829
Line1		111	165.0	0	1	75	0.31404	0.29108	0.0000041
Line2		111	254.0	0	1	75	0.31404	0.29108	0.0000041
Line3		111	393.0	0	1	75	0.31404	0.29108	0.0000041
Line4		111	259.0	0	1	75	0.31404	0.29108	0.0000041
Line5		111	765.0	0	1	75	0.31404	0.29108	0.0000041
Line6		111	50.0	0	1	75	0.31404	0.29108	0.0000041
Line7		111	2600.0	0	1	75	0.31404	0.29108	0.0000041
Line8		111	3600.0	0	1	75	0.31404	0.29108	0.0000041
Line9		111	3300.0	0	1	75	0.31404	0.29108	0.0000041
Line10		111	1818.0	0	1	75	0.31404	0.29108	0.0000041
Line11		111	360.0	0	1	75	0.31404	0.29108	0.0000041
Line12		111	65.0	0	1	75	0.31404	0.29108	0.0000041
Line13		111	609.0	0	1	75	0.31404	0.29108	0.0000041
Line14		111	822.0	0	1	75	0.31404	0.29108	0.0000041
Line15		111	200.0	0	1	75	0.31404	0.29108	0.0000041
Line16		111	449.0	0	1	75	0.31404	0.29108	0.0000041
Line17		111	1660.0	0	1	75	0.31404	0.29108	0.0000041
Line18		111	2070.0	0	1	75	0.31404	0.29108	0.0000041
Line19		111	609.0	0	1	75	0.31404	0.29108	0.0000041
Line20		111	300.0	0	1	75	0.31404	0.29108	0.0000041
Line21		111	684.0	0	1	75	0.31404	0.29108	0.0000041
Line22		111	555.0	0	1	75	0.31404	0.29108	0.0000041
Line23		111	1100.0	0	1	75	0.31404	0.29108	0.0000041
Line24		111	491.0	0	1	75	0.31404	0.29108	0.0000041
Line25		111	200.0	0	1	75	0.31404	0.29108	0.0000041
Line26		111	335.0	0	1	75	0.31404	0.29108	0.0000041
Line27		111	149.0	0	1	75	0.31404	0.29108	0.0000041
Line28		111	119.0	0	1	75	0.31404	0.29108	0.0000041
Line29		111	300.0	0	1	75	0.31404	0.29108	0.0000041
Line30		111	90.0	0	1	75	0.31404	0.29108	0.0000041
Line31		111	150.0	0	1	75	0.31404	0.29108	0.0000041
Line32		111	332.0	0	1	75	0.31404	0.29108	0.0000041
Line33		111	200.0	0	1	75	0.31404	0.29108	0.0000041
Line34		111	100.0	0	1	75	0.31404	0.29108	0.0000041
Line35		111	132.0	0	1	75	0.31404	0.29108	0.0000041
Line36		111	132.0	0	1	75	0.31404	0.29108	0.0000041

ohms or siemens/1000 m per Conductor (Cable) or per Phase (Line/Busway)									
Line/Cable/Busway		Length							
ID	Library	Size	Adj. (m)	% Tol.	#/Phase	T (°C)	R	X	Y
Line37		111	100.0	0	1	75	0.31404	0.29108	0.0000041
Line38		111	142.0	0	1	75	0.31404	0.29108	0.0000041
Line39		111	100.0	0	1	75	0.31404	0.29108	0.0000041
Line40		111	700.0	0	1	75	0.31404	0.29108	0.0000041
Line41		111	250.0	0	1	75	0.31404	0.29108	0.0000041
Line42		111	1450.0	0	1	75	0.31404	0.29108	0.0000041
Line43		111	230.0	0	1	75	0.31404	0.29108	0.0000041
Line44		111	777.0	0	1	75	0.31404	0.29108	0.0000041
Line45		111	1244.0	0	1	75	0.31404	0.29108	0.0000041

Line / Cable / Busway resistances are listed at the specified temperatures.

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2-Winding Transformer Input Data

Transformer	Rating					Z Variation			% Tap Setting		Adjusted
ID	MVA	Prim. kV	Sec. kV	% Z	X/R	+ 5%	- 5%	% Tol.	Prim.	Sec.	% Z
500KVA PRIMARY	0.500	11.000	0.415	5.00	3.50	0	0	0	5.000	2.500	5.0000
AIRTEL BIRNIN YERO	0.050	11.000	0.415	4.00	1.50	0	0	0	0	2.500	4.0000
ALHAJI BALA	0.300	11.000	0.415	4.00	1.50	0	0	0	0	0	4.0000
Aux TR	0.250	11.000	0.415	7.50	3.50	0	0	0	0	0	7.5000
BABBAN GIDA	0.300	11.000	0.415	5.00	3.50	0	0	0	0	0	5.0000
BIRNIN YERO 1	0.300	11.000	0.415	4.00	1.50	0	0	0	0	0	4.0000
BIRNIN YERO 1 RELIEF	0.300	11.000	0.415	4.00	1.50	0	0	0	0	2.500	4.0000
BIRNIN YERO 2	0.300	11.000	0.415	4.00	1.50	0	0	0	0	0	4.0000
DANDAMI	0.100	11.000	0.415	5.00	3.50	0	0	0	0	2.500	5.0000
FIRST GATE	0.500	11.000	0.415	5.00	3.50	0	0	0	0	0	5.0000
FOUNDATION	0.300	11.000	0.415	4.00	1.50	0	0	0	0	2.500	4.0000
FRSC	0.100	11.000	0.415	4.00	1.50	0	0	0	0	2.500	4.0000
HAYIN SADAUKI	0.300	11.000	0.415	4.00	1.50	0	0	0	0	0	4.0000
HAYIN UMMA	0.300	11.000	0.415	4.00	1.50	0	0	0	0	0	4.0000
HYDRAF WATER	0.300	11.000	0.415	4.00	1.50	0	0	0	0	2.500	4.0000
IHS BOOSTER STATION	0.050	11.000	0.415	5.00	3.50	0	0	0	0	0	5.0000
JAFI	0.500	11.000	0.415	4.00	1.50	0	0	0	0	0	4.0000
KAHO VILLAGE	0.300	11.000	0.415	5.00	3.50	0	0	0	0	0	5.0000
KAMPANIN PATE RELIEF	0.300	11.000	0.415	5.00	3.50	0	0	0	0	0	5.0000
KAN ZAURE	0.200	11.000	0.415	5.00	3.50	0	0	0	0	0	5.0000
KANGADA	0.500	11.000	0.415	5.00	3.50	0	0	0	0	0	5.0000
KARGO DAM	0.300	11.000	0.415	5.00	3.50	0	0	0	0	0	5.0000
MTN BIRNIN YERO	0.050	11.000	0.415	4.00	1.50	0	0	0	0	2.500	4.0000
POLICE DIVISION HG	0.200	11.000	0.415	4.00	1.50	0	0	0	0	2.500	4.0000
PROPOSED KWARAU	0.200	11.000	0.415	4.00	1.50	0	0	0	0	2.500	4.0000
VILLAGE R											
PULLO FARM	0.100	11.000	0.415	4.00	1.50	0	0	0	0	2.500	4.0000
SHEHU KARAWU	0.300	11.000	0.415	4.00	1.50	0	0	0	0	0	4.0000
SKYPET	0.200	11.000	0.415	4.00	1.50	0	0	0	0	2.500	4.0000
STS	6.600	11.000	0.800	7.50	3.50	0	0	0	5.000	0	7.5000
STS 2	6.600	11.000	0.800	8.35	13.00	0	0	0	6.250	0	8.3500
T2	5.000	11.000	0.415	7.15	8.50	0	0	0	7.300	0	7.1500
T10	0.100	11.000	0.415	5.00	3.50	0	0	0	0	0	5.0000
TSOHON BIRNIN YERO	0.300	11.000	0.415	4.00	1.50	0	0	0	0	0	4.0000
U/ RIMI	0.200	11.000	0.415	5.00	3.50	0	0	0	0	0	5.0000

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Transformer	Rating					Z Variation			% Tap Setting		Adjusted
ID	MVA	Prim. kV	Sec. kV	% Z	X/R	+ 5%	- 5%	% Tol.	Prim.	Sec.	% Z
URWA	0.050	11.000	0.415	4.00	1.50	0	0	0	0	2.500	4.0000
ZARIA ROAD 1 500KVA	0.500	11.000	0.415	4.00	1.50	0	0	0	5.000	2.500	4.0000
ZARIA ROAD 2	0.300	11.000	0.415	5.00	3.50	0	0	0	0	0	5.0000

Impedance Input Data

Impedance		Positive Sequence Impedanc			Unit
ID		R	X	Y	
Z4		0.001	0.001	0	% in 0.800 kV base and 100.0 MVA base
Z5		0.001	0.001	0.001	% in 0.415 kV base and 100.0 MVA base

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Branch Connections

CKT/Branch		Connected Bus ID		% Impedance, Pos. Seq., 100 MVAb			
ID	Type	From Bus	To Bus	R	X	Z	Y
500KVA PRIMARY	2W XFMR	Bus26	Bus87	293.65	1027.78	1068.91	
AIRTEL BIRNIN YERO	2W XFMR	Bus64	Bus107	4339.84	6509.77	7823.77	
ALHAJI BALA	2W XFMR	Bus74	Bus108	723.31	1084.96	1303.96	
Aux TR	2W XFMR	MV_BUS	Bus115	788.01	2758.02	2868.39	
BABBAN GIDA	2W XFMR	Bus38	Bus83	443.92	1553.72	1615.89	
BIRNIN YERO 1	2W XFMR	Bus56	Bus96	723.31	1084.96	1303.96	
BIRNIN YERO 1 RELIEF	2W XFMR	Bus47	Bus97	723.31	1084.96	1303.96	
BIRNIN YERO 2	2W XFMR	Bus60	Bus100	723.31	1084.96	1303.96	
DANDAMI	2W XFMR	Bus54	Bus94	1331.76	4661.15	4847.67	
FIRST GATE	2W XFMR	Bus40	Bus90	266.35	932.23	969.53	
FOUNDATION	2W XFMR	Bus76	Bus112	723.31	1084.96	1303.96	
FRSC	2W XFMR	Bus72	Bus109	2169.92	3254.88	3911.88	
HAYIN SADAUKI	2W XFMR	Bus62	Bus99	723.31	1084.96	1303.96	
HAYIN UMMA	2W XFMR	Bus57	Bus103	723.31	1084.96	1303.96	
HYDRAF WATER	2W XFMR	Bus79	Bus110	723.31	1084.96	1303.96	
IHS BOOSTER STATION	2W XFMR	Bus32	Bus86	2663.51	9322.29	9695.33	
JAFI	2W XFMR	Bus68	Bus104	433.98	650.98	782.38	
KAHO VILLAGE	2W XFMR	Bus36	Bus82	443.92	1553.72	1615.89	
KAMPANIN PATE RELIEF	2W XFMR	Bus41	Bus92	443.92	1553.72	1615.89	
KAN ZAURE	2W XFMR	Bus52	Bus91	665.88	2330.57	2423.83	
KANGADA	2W XFMR	Bus39	Bus88	266.35	932.23	969.53	
KARGO DAM	2W XFMR	Bus35	Bus84	443.92	1553.72	1615.89	
MTN BIRNIN YERO	2W XFMR	Bus63	Bus102	4339.84	6509.77	7823.77	
POLICE DIVISION HG	2W XFMR	Bus65	Bus106	1084.96	1627.44	1955.94	
PROPOSED KWARAU VILLAGE R	2W XFMR	Bus59	Bus98	1084.96	1627.44	1955.94	
PULLO FARM	2W XFMR	Bus78	Bus111	2169.92	3254.88	3911.88	
SHEHU KARAWU	2W XFMR	Bus61	Bus101	723.31	1084.96	1303.96	
SKYPET	2W XFMR	Bus67	Bus105	1084.96	1627.44	1955.94	
STS	2W XFMR	MV_BUS	Bus8	32.91	115.18	119.79	
STS 2	2W XFMR	MV_BUS	Bus114	10.41	135.29	135.69	
T2	2W XFMR	MV_BUS	Bus3	18.40	156.44	157.52	
T10	2W XFMR	Bus43	Bus89	1331.76	4661.15	4847.67	
TSOHON BIRNIN YERO	2W XFMR	Bus49	Bus93	723.31	1084.96	1303.96	
U/ RIMI	2W XFMR	Bus34	Bus85	665.88	2330.57	2423.83	
URWA	2W XFMR	Bus55	Bus95	4339.84	6509.77	7823.77	
ZARIA ROAD 1 500KVA	2W XFMR	Bus29	Bus81	478.47	717.70	862.57	

Project: MINI-GRID (IMG) 6.45MWp/10MWh
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CKT/Branch		Connected Bus ID		% Impedance, Pos. Seq., 100 MVAb			
ID	Type	From Bus	To Bus	R	X	Z	Y
ZARIA ROAD 2	2W XFMR	Bus30	Bus45	443.92	1553.72	1615.89	
Cable3	Cable	Bus15	MV_BUS	0.03	0.08	0.09	
Z4	Impedance	Bus114	Bus113	0.00	0.00	0.00	
Z5	Impedance	Bus115	Bus9	0.00	0.00	0.00	
Line1	Line	Bus2	Bus26	4.28	3.97	5.84	
Line2	Line	Bus26	Bus27	6.59	6.11	8.99	
Line3	Line	Bus28	Bus30	10.20	9.45	13.91	
Line4	Line	Bus27	Bus29	6.72	6.23	9.17	
Line5	Line	Bus27	Bus32	19.85	18.40	27.07	
Line6	Line	Bus32	Bus34	1.30	1.20	1.77	
Line7	Line	Bus34	Bus35	67.48	62.55	92.01	
Line8	Line	Bus32	Bus36	93.43	86.60	127.40	
Line9	Line	Bus37	Bus38	85.65	79.38	116.78	
Line10	Line	Bus27	Bus39	47.18	43.73	64.33	
Line11	Line	Bus40	Bus41	9.34	8.66	12.74	
Line12	Line	Bus39	Bus43	1.69	1.56	2.30	
Line13	Line	Bus39	Bus40	15.81	14.65	21.55	
Line14	Line	Bus48	Bus49	21.33	19.77	29.09	
Line15	Line	Bus46	Bus64	5.19	4.81	7.08	
Line16	Line	Bus56	Bus57	11.65	10.80	15.89	
Line17	Line	Bus41	Bus48	43.08	39.93	58.74	
Line18	Line	Bus48	Bus42	53.72	49.80	73.25	
Line19	Line	Bus56	Bus51	15.81	14.65	21.55	
Line20	Line	Bus42	Bus52	7.79	7.22	10.62	
Line21	Line	Bus42	Bus54	17.75	16.45	24.21	
Line22	Line	Bus54	Bus55	14.40	13.35	19.64	
Line23	Line	Bus55	Bus56	28.55	26.46	38.93	
Line24	Line	Bus56	Bus47	12.74	11.81	17.38	
Line25	Line	Bus47	Bus59	5.19	4.81	7.08	
Line26	Line	Bus56	Bus60	8.69	8.06	11.85	
Line27	Line	Bus60	Bus61	3.87	3.58	5.27	
Line28	Line	Bus51	Bus62	3.09	2.86	4.21	
Line29	Line	Bus51	Bus50	7.79	7.22	10.62	
Line30	Line	Bus50	Bus63	2.34	2.17	3.18	
Line31	Line	Bus50	Bus46	3.89	3.61	5.31	
Line32	Line	Bus46	Bus65	8.62	7.99	11.75	
Line33	Line	Bus50	Bus66	5.19	4.81	7.08	
Line34	Line	Bus66	Bus67	2.60	2.41	3.54	
Line35	Line	Bus66	Bus68	3.43	3.18	4.67	

Project: MINI-GRID (IMG) 6.45MWp/10MWh
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CKT/Branch		Connected Bus ID		% Impedance, Pos. Seq., 100 MVAb			
ID	Type	From Bus	To Bus	R	X	Z	Y
Line36	Line	Bus66	Bus70	3.43	3.18	4.67	
Line37	Line	Bus70	Bus72	2.60	2.41	3.54	
Line38	Line	Bus70	Bus73	3.69	3.42	5.03	
Line39	Line	Bus73	Bus74	2.60	2.41	3.54	
Line40	Line	Bus73	Bus75	18.17	16.84	24.77	
Line41	Line	Bus75	Bus76	6.49	6.01	8.85	
Line42	Line	Bus75	Bus77	37.63	34.88	51.31	
Line43	Line	Bus77	Bus78	5.97	5.53	8.14	
Line44	Line	Bus80	Bus79	20.17	18.69	27.50	
Line45	Line	Bus77	Bus80	32.29	29.93	44.02	
CB2	Tie Breaker	MV_BUS	Bus2				
CB32	Tie Breaker	Bus36	Bus37				
CB33	Tie Breaker	Bus29	Bus28				

Project: MINI-GRID (IMG) 6.45MWp/10MWh
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Power Grid Input Data

Power Grid		Connected Bus		Rating		% Impedance 100 MVA Base		
ID		ID		MVASC	kV	R	X"	R/X
U1		Bus15		250.000	11.000	3.98015	39.80149	0.10

Total Connected Power Grids (= 1): 250.000 MVA

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Synchronous Motor Input Data

Synchronous Motor			Connected Bus	Rating				
ID	Type	Qty	ID	HP/kW	kVA	kV	Amp	PF
Syn1	Motor	1	Bus87	7.00	8.2	0.415	11.44	85.69

Total Connected Synchronous Motors (= 1): 8.2 kVA

Synchronous Motor			% Impedance in Motor Base				Exciter Type
			Xd"				
ID	Type	Qty	R	Adj.	Tol.	R/X"	
Syn1	Motor	1	8.089	16.67	0.0	0.49	Turbine 130%

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UPS Input Data

ID	AC Rating							DC Rating			Bypass Switch	% Impedance Equipment Base	
	kVA	kV		FLA		% EFF	% PF					V	FLA
		Input	Output	Input	Output								
UPS1	20.00	0.415	0.415	30.92	27.82	90.00	85.00	49.51	362.441	150.0	No	66.67	0.00

Project: MINI-GRID (IMG) 6.45MWp/10MWh
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SHORT-CIRCUIT REPORT

3-Phase fault at bus: **Bus8**

Nominal kV = 0.800
Voltage c Factor = 1.05 (User-Defined)
Peak Value = 112.869 kA Method C
Steady State = 53.997 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Bus8	Total	0.00	12.758	-52.469	4.1	53.997
MV_BUS	Bus8	81.71	12.758	-50.087	3.9	51.686
PVA1	Bus8	0.00	0.000	-0.119 37320540.0		0.119
PVA2	Bus8	0.00	0.000	-0.119 37320540.0		0.119
PVA3	Bus8	0.00	0.000	-0.119 37320540.0		0.119
PVA4	Bus8	0.00	0.000	-0.119 37320540.0		0.119
PVA5	Bus8	0.00	0.000	-0.119 37320540.0		0.119
PVA6	Bus8	0.00	0.000	-0.119 37320540.0		0.119
PVA7	Bus8	0.00	0.000	-0.119 37320540.0		0.119
PVA8	Bus8	0.00	0.000	-0.119 37320540.0		0.119
PVA9	Bus8	0.00	0.000	-0.119 37320540.0		0.119
PVA10	Bus8	0.00	0.000	-0.119 37320540.0		0.119
PVA11	Bus8	0.00	0.000	-0.119 37320540.0		0.119
PVA12	Bus8	0.00	0.000	-0.119 37320540.0		0.119
PVA13	Bus8	0.00	0.000	-0.119 37320540.0		0.119
PVA14	Bus8	0.00	0.000	-0.119 37320540.0		0.119
PVA15	Bus8	0.00	0.000	-0.119 37320540.0		0.119
PVA16	Bus8	0.00	0.000	-0.119 37320540.0		0.119
PVA17	Bus8	0.00	0.000	-0.119 37320540.0		0.119
PVA18	Bus8	0.00	0.000	-0.119 37320540.0		0.119
PVA20	Bus8	0.00	0.000	-0.119 37320540.0		0.119
PVA21	Bus8	0.00	0.000	-0.119 37320540.0		0.119
Bus15	MV_BUS	81.76	0.620	-3.357	5.4	3.414
Bus115	MV_BUS	81.71	0.000	0.000	999.9	0.000
Bus114	MV_BUS	80.16	0.264	-0.111	0.4	0.286
Bus3	MV_BUS	76.15	0.000	0.000	999.9	0.000
Bus26	Bus2	81.71	0.000	-0.001	1.7	0.001

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3-Phase fault at bus: **Bus8**

Nominal kV = 0.800
Voltage c Factor = 1.05 (User-Defined)
Peak Value = 112.869 kA Method C
Steady State = 53.997 kA rms

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

<u>TD (S)</u>	<u>Ib sym</u>	<u>Ib asym</u>	<u>Idc</u>
0.01	53.997	64.135	34.606
0.02	53.997	56.479	16.558
0.03	53.997	54.576	7.923
0.04	53.997	54.130	3.791
0.05	53.997	54.028	1.814
0.06	53.997	54.004	0.868
0.07	53.997	53.999	0.415
0.08	53.997	53.998	0.199
0.09	53.997	53.998	0.095
0.10	53.997	53.998	0.045
0.15	53.997	53.997	0.001
0.20	53.997	53.997	0.000
0.25	53.997	53.997	0.000
0.30	53.997	53.997	0.000

Project: MINI-GRID (IMG) 6.45MWp/10MWh
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3-Phase fault at bus: **Bus110**

Nominal kV = 0.415
Voltage c Factor = 1.05 (User-Defined)
Peak Value = 12.012 kA Method C
Steady State = 7.569 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Bus110	Total	0.00	4.787	-5.863	1.2	7.569
Bus79	Bus110	72.71	4.787	-5.863	1.2	7.569
Bus80	Bus79	74.21	0.185	-0.227	1.2	0.293

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

TD (S)	Ib sym	Ib asym	Idc
0.01	7.569	7.635	1.007
0.02	7.569	7.569	0.096
0.03	7.569	7.569	0.009
0.04	7.569	7.569	0.001
0.05	7.569	7.569	0.000
0.06	7.569	7.569	0.000
0.07	7.569	7.569	0.000
0.08	7.569	7.569	0.000
0.09	7.569	7.569	0.000
0.10	7.569	7.569	0.000
0.15	7.569	7.569	0.000
0.20	7.569	7.569	0.000
0.25	7.569	7.569	0.000
0.30	7.569	7.569	0.000

3-Phase fault at bus: **Bus113**

Nominal kV = 0.800
Voltage c Factor = 1.05 (User-Defined)
Peak Value = 123.655 kA Method C
Steady State = 50.100 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Bus113	Total	0.00	5.058	-49.844	9.9	50.100
Bus114	Bus113	0.00	5.058	-47.795	9.4	48.061
PCS 1	Bus113	0.00	0.000	-0.085	37320540.0	0.085
PCS 2	Bus113	0.00	0.000	-0.085	37320540.0	0.085
PCS 3	Bus113	0.00	0.000	-0.085	37320540.0	0.085
PCS 4	Bus113	0.00	0.000	-0.085	37320540.0	0.085
PCS 5	Bus113	0.00	0.000	-0.085	37320540.0	0.085
PCS 6	Bus113	0.00	0.000	-0.085	37320540.0	0.085
PCS 7	Bus113	0.00	0.000	-0.085	37320540.0	0.085
PCS 8	Bus113	0.00	0.000	-0.085	37320540.0	0.085
PCS 9	Bus113	0.00	0.000	-0.085	37320540.0	0.085
PCS 10	Bus113	0.00	0.000	-0.085	37320540.0	0.085
PCS 11	Bus113	0.00	0.000	-0.085	37320540.0	0.085
PCS 12	Bus113	0.00	0.000	-0.085	37320540.0	0.085
PCS 13	Bus113	0.00	0.000	-0.085	37320540.0	0.085
PCS 14	Bus113	0.00	0.000	-0.085	37320540.0	0.085
PCS 15	Bus113	0.00	0.000	-0.085	37320540.0	0.085
PCS 16	Bus113	0.00	0.000	-0.085	37320540.0	0.085
PCS 17	Bus113	0.00	0.000	-0.085	37320540.0	0.085
PCS 18	Bus113	0.00	0.000	-0.085	37320540.0	0.085
PCS 19	Bus113	0.00	0.000	-0.085	37320540.0	0.085
PCS 20	Bus113	0.00	0.000	-0.085	37320540.0	0.085
PCS 21	Bus113	0.00	0.000	-0.085	37320540.0	0.085
PCS 22	Bus113	0.00	0.000	-0.085	37320540.0	0.085
PCS 23	Bus113	0.00	0.000	-0.085	37320540.0	0.085
PCS 24	Bus113	0.00	0.000	-0.085	37320540.0	0.085
MV_BUS	Bus114	85.05	5.058	-47.795	9.4	48.061

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3-Phase fault at bus: **Bus113**

Nominal kV = 0.800
Voltage c Factor = 1.05 (User-Defined)
Peak Value = 123.655 kA Method C
Steady State = 50.100 kA rms

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

<u>TD (S)</u>	<u>Ib sym</u>	<u>Ib asym</u>	<u>Idc</u>
0.01	50.100	72.137	51.901
0.02	50.100	64.125	40.025
0.03	50.100	58.845	30.866
0.04	50.100	55.468	23.804
0.05	50.100	53.358	18.357
0.06	50.100	52.062	14.157
0.07	50.100	51.276	10.917
0.08	50.100	50.803	8.419
0.09	50.100	50.519	6.493
0.10	50.100	50.350	5.007
0.15	50.100	50.119	1.366
0.20	50.100	50.102	0.373
0.25	50.100	50.101	0.102
0.30	50.100	50.100	0.028

3-Phase fault at bus: MV_BUS

Nominal kV = 11.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 32.805 kA Method C
Steady State = 13.436 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
MV_BUS	Total	0.00	1.311	-13.374	10.2	13.438
Bus15	MV_BUS	0.22	1.310	-13.030	9.9	13.096
Bus115	MV_BUS	0.00	0.000	0.000	999.9	0.000
Bus8	MV_BUS	4.02	0.000	-0.185	999.9	0.185
Bus114	MV_BUS	3.80	0.000	-0.156	999.9	0.156
Bus3	MV_BUS	0.00	0.000	0.000	999.9	0.000
Bus26	Bus2	0.00	0.001	-0.002	2.1	0.003
U1	Bus15	110.00	1.310	-13.030	9.9	13.096
Bus9	Bus115	0.00	0.000	0.000	999.9	0.000
PVA1	Bus8	4.02	0.000	-0.133 37320540.0		0.133
PVA2	Bus8	4.02	0.000	-0.133 37320540.0		0.133
PVA3	Bus8	4.02	0.000	-0.133 37320540.0		0.133
PVA4	Bus8	4.02	0.000	-0.133 37320540.0		0.133
PVA5	Bus8	4.02	0.000	-0.133 37320540.0		0.133
PVA6	Bus8	4.02	0.000	-0.133 37320540.0		0.133
PVA7	Bus8	4.02	0.000	-0.133 37320540.0		0.133
PVA8	Bus8	4.02	0.000	-0.133 37320540.0		0.133
PVA9	Bus8	4.02	0.000	-0.133 37320540.0		0.133
PVA10	Bus8	4.02	0.000	-0.133 37320540.0		0.133
PVA11	Bus8	4.02	0.000	-0.133 37320540.0		0.133
PVA12	Bus8	4.02	0.000	-0.133 37320540.0		0.133
PVA13	Bus8	4.02	0.000	-0.133 37320540.0		0.133
PVA14	Bus8	4.02	0.000	-0.133 37320540.0		0.133
PVA15	Bus8	4.02	0.000	-0.133 37320540.0		0.133
PVA16	Bus8	4.02	0.000	-0.133 37320540.0		0.133
PVA17	Bus8	4.02	0.000	-0.133 37320540.0		0.133
PVA18	Bus8	4.02	0.000	-0.133 37320540.0		0.133
PVA20	Bus8	4.02	0.000	-0.133 37320540.0		0.133
PVA21	Bus8	4.02	0.000	-0.133 37320540.0		0.133
Bus113	Bus114	3.80	0.000	-2.284	999.9	2.284

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3-Phase fault at bus: MV_BUS

Nominal kV = 11.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 32.805 kA Method C
Steady State = 13.436 kA rms

Contribution		Voltage & Initial Symmetrical Current (rms)				
From Bus ID	To Bus ID	% V From Bus	kA Real	kA Imaginary	X/R Ratio	kA Magnitude
Bus27	Bus26	0.00	0.000	0.000	999.9	0.000
Bus87	Bus26	0.50	0.001	-0.002	2.1	0.003
PCS 1	Bus113	3.80	0.000	-0.095	37320540.0	0.095
PCS 2	Bus113	3.80	0.000	-0.095	37320540.0	0.095
PCS 3	Bus113	3.80	0.000	-0.095	37320540.0	0.095
PCS 4	Bus113	3.80	0.000	-0.095	37320540.0	0.095
PCS 5	Bus113	3.80	0.000	-0.095	37320540.0	0.095
PCS 6	Bus113	3.80	0.000	-0.095	37320540.0	0.095
PCS 7	Bus113	3.80	0.000	-0.095	37320540.0	0.095
PCS 8	Bus113	3.80	0.000	-0.095	37320540.0	0.095
PCS 9	Bus113	3.80	0.000	-0.095	37320540.0	0.095
PCS 10	Bus113	3.80	0.000	-0.095	37320540.0	0.095
PCS 11	Bus113	3.80	0.000	-0.095	37320540.0	0.095
PCS 12	Bus113	3.80	0.000	-0.095	37320540.0	0.095
PCS 13	Bus113	3.80	0.000	-0.095	37320540.0	0.095
PCS 14	Bus113	3.80	0.000	-0.095	37320540.0	0.095
PCS 15	Bus113	3.80	0.000	-0.095	37320540.0	0.095
PCS 16	Bus113	3.80	0.000	-0.095	37320540.0	0.095
PCS 17	Bus113	3.80	0.000	-0.095	37320540.0	0.095
PCS 18	Bus113	3.80	0.000	-0.095	37320540.0	0.095
PCS 19	Bus113	3.80	0.000	-0.095	37320540.0	0.095
PCS 20	Bus113	3.80	0.000	-0.095	37320540.0	0.095
PCS 21	Bus113	3.80	0.000	-0.095	37320540.0	0.095
PCS 22	Bus113	3.80	0.000	-0.095	37320540.0	0.095
PCS 23	Bus113	3.80	0.000	-0.095	37320540.0	0.095
PCS 24	Bus113	3.80	0.000	-0.095	37320540.0	0.095
Bus2	MV_BUS	0.00	0.001	-0.002	2.1	0.003

Project: MINI-GRID (IMG) 6.45MWp/10MWh
Location: JAJI, KADUNA
Contract:
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(Cont.)

3-Phase fault at bus: MV_BUS

Nominal kV = 11.000
Voltage c Factor = 1.10 (User-Defined)
Peak Value = 32.805 kA Method C
Steady State = 13.436 kA rms

Breaking and DC Fault Current (kA)

Based on Total Bus Fault Current

<u>TD (S)</u>	<u>Ib sym</u>	<u>Ib asym</u>	<u>Idc</u>
0.01	13.438	19.052	13.506
0.02	13.438	16.660	9.849
0.03	13.438	15.236	7.182
0.04	13.438	14.422	5.237
0.05	13.437	13.970	3.819
0.06	13.437	13.723	2.785
0.07	13.437	13.590	2.031
0.08	13.437	13.519	1.481
0.09	13.437	13.481	1.080
0.10	13.437	13.460	0.787
0.15	13.437	13.438	0.162
0.20	13.437	13.437	0.033
0.25	13.437	13.437	0.007
0.30	13.437	13.437	0.001

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Engineer:	A. ADEFEMI	Study Case: SC	Revision:	Base
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Short-Circuit Summary Report

3-Phase Fault Currents

Bus		Device		Device Capacity (kA)				Short-Circuit Current (kA)					
				Making				I"k	ip	Ib sym	Ib asym	Idc	Ik
ID	kV	ID	Type	Peak	Ib sym	Ib asym	Idc						
Bus8	0.800	Bus8	Bus					53.997	112.869				53.997
Bus110	0.415	Bus110	Bus					7.569	12.012				7.569
Bus113	0.800	Bus113	Bus					50.100	123.655				50.100
MV_BUS	11.000	MV_BUS	Bus					13.438	32.805				13.436
	11.000	CB3	CB	63.000	25.000	29.813	16.243	13.438	32.805	13.438	14.771	6.133	

ip is calculated using method C
Ib does not include decay of non-terminal faulted induction motors
Ik is the maximum steady state fault current
Idc is based on X/R from Method C and Ib as specified above

LV CB duty determined based on service rating.
Total through current is used for device duty.

- * Indicates a device with calculated duty exceeding the device capability.
- # Indicates a device with calculated duty exceeding the device marginal limit. (95 % times device capability)

Project: MINI-GRID (IMG) 6.45MWp/10MWh
Location: JAJI, KADUNA
Contract:
Engineer: A. ADEFEMI
Filename: AES RENEWABLES

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Short-Circuit Summary Report

Bus ID	Device ID	Device Capacity			3-Phase Short-Circuit Duty Results		
		Ithr (kA)	Tkr (sec.)	Rated Thermal Energy (MJ)	Ith (kA)	Tkr (sec.)	Thermal Energy (MJ)
MV_BUS	CB3	25.000	1.00	625.00	13.664	1.00	186.71

Ithr = Rated short-time withstand current (Icw for low voltage circuit breaker)
Tkr = Rated short-time
Ith = Thermal equivalent short-time current

* Indicates a device with calculated duty exceeding the device capability.
Indicates a device with calculated duty exceeding the device marginal limit . (95 % times device capability)