

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

Battery Discharge Calculation

Battery ID: Battery1

Duty Cycle Category: Normal

Duty Cycle from: DC Load Flow Calculation

Load Duration: 5.0 hours

Diversity Factor: 100 %

	Voltage Reg.	Load	Total
Number of Buses:	0	2	2

	Charger	UPS	Inverter	DC Converter	Total
Number of Converters:	0	0	24	0	24

	Cable/Busway	Impedance	Tie PD	Total
Number of Branches:	0	1	0	1

	Battery
Number of Batteries:	1

	Motor	Static Load	Lumped Load	Composite CSD	Total
Number of Loads:	0	0	0	0	0

Unit System: Metric

Project File: AES RENEWABLES

Output File: C:\ETAP 2401\AES RENEWABLES\BESS Autonomy Under Zero-PV.DB1S

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Impedance Input Data

Impedance		Connected Buses		Impedance	
ID	From	To	ohm	(%)100 MVAb	
dcZ8	BATT BUS	dcBus1	0.01000	41.77	

Inverter Input Data

Inverter	Rating Parameters							Operating Parameters	
	AC		DC			% EFF	% PF		
	ID	kVA	kV	kW	V			FLA	Vreg.
PCS 1	236.70	0.80	263.00	1546.00	170.12	90.00	100.00	0.00	0.00
PCS 2	236.70	0.80	263.00	1546.00	170.12	90.00	100.00	0.00	0.00
PCS 3	236.70	0.80	263.00	1546.00	170.12	90.00	100.00	0.00	0.00
PCS 4	236.70	0.80	263.00	1546.00	170.12	90.00	100.00	0.00	0.00
PCS 5	236.70	0.80	263.00	1546.00	170.12	90.00	100.00	0.00	0.00
PCS 6	236.70	0.80	263.00	1546.00	170.12	90.00	100.00	0.00	0.00
PCS 7	236.70	0.80	263.00	1546.00	170.12	90.00	100.00	0.00	0.00
PCS 8	236.70	0.80	263.00	1546.00	170.12	90.00	100.00	0.00	0.00
PCS 9	236.70	0.80	263.00	1546.00	170.12	90.00	100.00	0.00	0.00
PCS 10	236.70	0.80	263.00	1546.00	170.12	90.00	100.00	0.00	0.00
PCS 11	236.70	0.80	263.00	1546.00	170.12	90.00	100.00	0.00	0.00
PCS 12	236.70	0.80	263.00	1546.00	170.12	90.00	100.00	0.00	0.00
PCS 13	236.70	0.80	263.00	1546.00	170.12	90.00	100.00	0.00	0.00
PCS 14	236.70	0.80	263.00	1546.00	170.12	90.00	100.00	0.00	0.00
PCS 15	236.70	0.80	263.00	1546.00	170.12	90.00	100.00	0.00	0.00
PCS 16	236.70	0.80	263.00	1546.00	170.12	90.00	100.00	0.00	0.00
PCS 17	236.70	0.80	263.00	1546.00	170.12	90.00	100.00	0.00	0.00
PCS 18	236.70	0.80	263.00	1546.00	170.12	90.00	100.00	0.00	0.00
PCS 19	236.70	0.80	263.00	1546.00	170.12	90.00	100.00	0.00	0.00
PCS 20	236.70	0.80	263.00	1546.00	170.12	90.00	100.00	0.00	0.00
PCS 21	236.70	0.80	263.00	1546.00	170.12	90.00	100.00	0.00	0.00
PCS 22	236.70	0.80	263.00	1546.00	170.12	90.00	100.00	0.00	0.00
PCS 23	236.70	0.80	263.00	1546.00	170.12	90.00	100.00	0.00	0.00
PCS 24	236.70	0.80	263.00	1546.00	170.12	90.00	100.00	0.00	0.00

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Branch / Converter / UPS Connections

CKT/Branch		Connected Bus ID		Impedance	
ID	Type	From Bus	To Bus	(ohm)	(%) 100 MVA _b
dcZ8	Impedance	BATT BUS	dcBus1	0.02000	83.54
PCS 1	Inverter	BATT BUS			
PCS 10	Inverter	BATT BUS			
PCS 11	Inverter	BATT BUS			
PCS 12	Inverter	BATT BUS			
PCS 13	Inverter	BATT BUS			
PCS 14	Inverter	BATT BUS			
PCS 15	Inverter	BATT BUS			
PCS 16	Inverter	BATT BUS			
PCS 17	Inverter	BATT BUS			
PCS 18	Inverter	BATT BUS			
PCS 19	Inverter	BATT BUS			
PCS 2	Inverter	BATT BUS			
PCS 20	Inverter	BATT BUS			
PCS 21	Inverter	BATT BUS			
PCS 22	Inverter	BATT BUS			
PCS 23	Inverter	BATT BUS			
PCS 24	Inverter	BATT BUS			
PCS 3	Inverter	BATT BUS			
PCS 4	Inverter	BATT BUS			
PCS 5	Inverter	BATT BUS			
PCS 6	Inverter	BATT BUS			
PCS 7	Inverter	BATT BUS			
PCS 8	Inverter	BATT BUS			
PCS 9	Inverter	BATT BUS			

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Duty Cycle

Load ID: PCS 1

Non-Random Load			Random Load	
t1 (s)	t2 (s)	Amp	Duration (s)	Amp
0.000	18000.000	58.00		

Load ID: PCS 10

Non-Random Load			Random Load	
t1 (s)	t2 (s)	Amp	Duration (s)	Amp
0.000	18000.000	58.00		

Load ID: PCS 11

Non-Random Load			Random Load	
t1 (s)	t2 (s)	Amp	Duration (s)	Amp
0.000	18000.000	58.00		

Load ID: PCS 12

Non-Random Load			Random Load	
t1 (s)	t2 (s)	Amp	Duration (s)	Amp
0.000	18000.000	58.00		

Load ID: PCS 13

Non-Random Load			Random Load	
t1 (s)	t2 (s)	Amp	Duration (s)	Amp
0.000	18000.000	58.00		

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Load ID: PCS 14

Non-Random Load			Random Load	
t1 (s)	t2 (s)	Amp	Duration (s)	Amp
0.000	18000.000	58.00		

Load ID: PCS 15

Non-Random Load			Random Load	
t1 (s)	t2 (s)	Amp	Duration (s)	Amp
0.000	18000.000	58.00		

Load ID: PCS 16

Non-Random Load			Random Load	
t1 (s)	t2 (s)	Amp	Duration (s)	Amp
0.000	18000.000	58.00		

Load ID: PCS 17

Non-Random Load			Random Load	
t1 (s)	t2 (s)	Amp	Duration (s)	Amp
0.000	18000.000	58.00		

Load ID: PCS 18

Non-Random Load			Random Load	
t1 (s)	t2 (s)	Amp	Duration (s)	Amp
0.000	18000.000	58.00		

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Load ID: PCS 19

Non-Random Load			Random Load	
t1 (s)	t2 (s)	Amp	Duration (s)	Amp
0.000	18000.000	58.00		

Load ID: PCS 2

Non-Random Load			Random Load	
t1 (s)	t2 (s)	Amp	Duration (s)	Amp
0.000	18000.000	58.00		

Load ID: PCS 20

Non-Random Load			Random Load	
t1 (s)	t2 (s)	Amp	Duration (s)	Amp
0.000	18000.000	58.00		

Load ID: PCS 21

Non-Random Load			Random Load	
t1 (s)	t2 (s)	Amp	Duration (s)	Amp
0.000	18000.000	58.00		

Load ID: PCS 22

Non-Random Load			Random Load	
t1 (s)	t2 (s)	Amp	Duration (s)	Amp
0.000	18000.000	58.00		

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Load ID: PCS 23

Non-Random Load			Random Load	
t1 (s)	t2 (s)	Amp	Duration (s)	Amp
0.000	18000.000	58.00		

Load ID: PCS 24

Non-Random Load			Random Load	
t1 (s)	t2 (s)	Amp	Duration (s)	Amp
0.000	18000.000	58.00		

Load ID: PCS 3

Non-Random Load			Random Load	
t1 (s)	t2 (s)	Amp	Duration (s)	Amp
0.000	18000.000	58.00		

Load ID: PCS 4

Non-Random Load			Random Load	
t1 (s)	t2 (s)	Amp	Duration (s)	Amp
0.000	18000.000	58.00		

Load ID: PCS 5

Non-Random Load			Random Load	
t1 (s)	t2 (s)	Amp	Duration (s)	Amp
0.000	18000.000	58.00		

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Load ID: PCS 6

Non-Random Load			Random Load	
t1 (s)	t2 (s)	Amp	Duration (s)	Amp
0.000	18000.000	58.00		

Load ID: PCS 7

Non-Random Load			Random Load	
t1 (s)	t2 (s)	Amp	Duration (s)	Amp
0.000	18000.000	58.00		

Load ID: PCS 8

Non-Random Load			Random Load	
t1 (s)	t2 (s)	Amp	Duration (s)	Amp
0.000	18000.000	58.00		

Load ID: PCS 9

Non-Random Load			Random Load	
t1 (s)	t2 (s)	Amp	Duration (s)	Amp
0.000	18000.000	58.00		

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Battery ID: Battery1
Method: Load Flow Calculation

Battery Load Profile

Non-Random Load			Random Load		
t1 (s)	t2 (s)	Amp	t1 (s)	t2 (s)	Amp
0.000	18000.000	1418.01	0.000	0.000	0.00
18000.000		0.00			

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Battery Characteristics

MFR: C&D Tech
Model: LCR
Type: Time vs amp
V/Cell: 2.063
Rp: 0.001400 Resistance/Positive Plate
Temp: 25 °C
No of Plates: 15
Capacity: 1050 AH
1 Min. A Rate: 1029

Battery sizes given in the library are used as min/max range.

Ampere per Positive Plate as a Function of Time (minutes) and Voltage (volts)

Time	1.75 #	1.78	1.81	1.85
1.00	147.00	127.29	107.14	82.43
15.00	120.57	108.29	94.71	75.43
30.00	100.57	92.57	83.29	68.43
60.00	76.00	71.57	66.29	56.71
120.00	52.00	49.86	47.00	41.57
180.00	40.00	38.57	36.71	33.00
240.00	32.57	31.57	30.14	27.43
300.00	27.57	26.71	25.71	23.57
480.00	18.86	18.43	17.86	16.71
720.00	13.29	13.14	12.86	12.14

Indicates the curve used in battery sizing.

* The ampere value is missing in the battery library and this value was estimated based on user entered library data.

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Battery Discharge Summary Page

Battery ID: **Battery1**
Number of cells: 25
Number of Packs: 30
Number of Strings: 6
Rated Voltage: 1547.25
Rated Capacity: 6300 AH

Duty Cycle Category: Normal
Load Duration: 5.0 hours

Voltage Requirements:

System: Nominal Voltage = 1546.00
Maximum System Voltage Deviation = 120 %
Minimum System Voltage Deviation = 80 %

Battery: Battery Charge Voltage = 2.30 V/Cell
Battery Minimum Discharge Voltage = 1.75 V/Cell

Temperature = 25 °C (Battery minimum temperature)

Voltage Drop Calculation Parameters:

Time Step = 1.00 Minute
Maximum Voltage Limit = 100.0 %

Voltage Drop Calculation Parameters:

One-minute Span for Battery and Load

Correction Factors (%):

Using Adjusted Battery Capacity

Temperature	Aging	Initial Capacity	Total
100.0	100	100	100.0