Week 7 Meeting

10/15/18
Team Leader: Ahmed
Other Team Members: Katayi,Nur, Chufu, Tam, YJ
Advisor: Dr. Ajjarapu

Safety Moment: Walking on Ice

- Do not walk on ice if possible.
- If you are still going to do that, be careful of the following:
  - Check with local authorities before heading out at any time
  - Check website for depths of local ponds and lakes
  - Avoid going out on ice at night
  - Carry readily accessible ice picks
  - Wear a personal floatation device

- To identify ice strength
  - Clear blue ice is the strongest
  - White opaque or snow ice is half as strong
  - Grey ice is unsafe

Topics

- Voltage Drop Calculations
- Ground Coverage Ratio
- Final Solar Layout
- Collector
- Feeder

The value of power per rack that we got from the template does not match the calculation from the array parameter tool, did we input the values wrong for vmp and imp?

8 Input Disconnect Combiner Box								
Circuit	from	to	power (W)	Voltage (Vmp)	Current (Imp)	DCB Fuse (A)	Cable Size (AWG)	Cable Length (Ft)
1	ER - 1	DCB	28,674	972	29.5	30	10	200.3
2	ER - 2	DCB	28,674	972	29.5	30	10	137.9
3	ER - 3	DCB	28,674	972	29.5	30	10	75.5
4	ER - 4	DCB	28,674	972	29.5	30	10	14.1
5	ER - 5	DCB	28,674	972	29.5	30	10	14.1
6	ER - 6	DCB	28,674	972	29.5	30	10	75.5
7	ER - 7	DCB	28,674	972	29.5	30	10	137.9
8	ER - 8	DCB	28,674	972	29.5	30	10	200.3
Total:			229,392		236			

What is DCB whip wire referring to?

Why did you use 500 to calculate the rack harness resistance? `=ROUND(E4*G4/500,3)`

Strings per Harness	IMP for circuit	Rack Harness Length	Rack Harness wire size	Rack Harness resistance	Rack Harness resistance	Voltage Drop from Rack to CB	Jumper Length	Jumper wire size	Jumper resistance	Jumper resistance	Voltage Drop Across a String	DCB Whip length	DCB Whip wire size	DCB Whip resistance	DCB Whip resistance	Total resistance	Total voltage drop	Voltage drop for branch
per rack	Amp	feet	AWG	Ohm/kft	Ohm	Volts	feet	AWG	Ohm/kft	Ohm	Volts	feet	AWG	Ohm/kft	Ohm	Ohm	Volts	percent
2	29.5	200.3	10	0.9989	0.4	4.72708	62.4	12	1.588	0.198	0.3644784					0.598	5.0915584	0.52%
2	29.5	137.9	10	0.9989	0.275	2.2374275	62.4	12	1.588	0.198	0.3644784					0.473	2.6019059	0.27%
2	29.5	75.5	10	0.9989	0.151	0.6726295	62.4	12	1.588	0.198	0.3644784					0.349	1.0371079	0.11%
2	29.5	14.1	10	0.9989	0.028	0.0232932	62.4	12	1.588	0.198	0.3644784					0.226	0.3877716	0.04%
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2	29.5	75.5	10	0.9989	0.151	0.6726295	62.4	12	1.588	0.198	0.3644784					0.349	1.0371079	0.11%
2	29.5	137.9	10	0.9989	0.275	2.2374275	62.4	12	1.588	0.198	0.3644784					0.473	2.6019059	0.27%
2	29.5	200.3	10	0.9989	0.4	4.72708	62.4	12	1.588	0.198	0.3644784					0.598	5.0915584	0.52%
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2	29.5	200.3	10	0.9989	0.4	4.72708	62.4	12	1.588	0.198	0.3644784					0.598	5.0915584	0.52%

Why is it red?

Disconnect Combiner Box NUMBER	INPUT DC FUSE SIZE	NUMBER OF STRINGS	NUMBER OF INPUTS	SHORT CIRCUIT CURRENT (ISC)	MAX POWER CURRENT (IMP)	MAX POWER VOLTAGE (VMP)	DC FEEDER WIRE SIZE AND TYPE	ONE WAY DISTANCE NOT TO EXCEED (FT)
DCB#-##	AMP			AMP	AMP	VOLT		
				18.8	29.50	972		
DCB1-01	30	16	8	150	236	972	(<QUANTITY>) - <WIRE SIZE AND TYPE>	
DCB1-02	30	16	8	150	236	972		
DCB1-03	30	16	8	150	236	972		
DCB1-04	30	16	8	150	236	972		
DCB1-05	30	16	8	150	236	972		
DCB1-06	30	16	8	150	236	972		
DCB1-07	30	16	8	150	236	972		
DCB1-08	30	16	8	150	236	972		
DCB1-09	30	16	8	150	236	972		
DCB1-10	30	16	8	150	236	972		
DCB1-11	30	14	7	150	207	972		
DCB1-12	30	14	7	150	207	972		
DCB1-13	30	16	8	150	236	972		
DCB1-14	30	16	8	150	236	972		
DCB1-15	30	16	8	150	236	972		
DCB1-16	30	16	8	150	236	972		
DCB1-17	30	16	8	150	236	972		
DCB1-18	30	16	8	150	236	972		
DCB1-19	30	16	8	150	236	972		
DCB1-20	30	16	8	150	236	972		
DCB1-21	30	16	8	150	236	972		
DCB1-22	30	16	8	150	236	972		
INVERTER 1 TOTALS		348	174	3302	5133	972		

Results From Voltage Drop Calculation Sheet - Summary

Based NEC310 Table 300.50:

Conductors	Max Isc(A)	Type	Material	AWG
String	14.75	free air	Copper	12
Rack to CB	29.5	free air	Copper	10
CB to Inverter	236	Underground	Aluminum	
Inverter to Transformer	5133	Underground	Aluminum	

Results From Voltage Drop Calculation Sheet - Summary

Combiner	Strings	Racks in	Per CB Output (A)
1	16	8	236
2	16	8	236
3	16	8	236
4	16	8	236
5	16	8	236
6	16	8	236
7	16	8	236
8	16	8	236
9	16	8	236
10	16	8	236
11	14	7	206.5
12	14	7	206.5
13	16	8	236
14	16	8	236
15	16	8	236
16	16	8	236
17	16	8	236
18	16	8	236
19	16	8	236
20	16	8	236
21	16	8	236
22	16	8	236
Total			**5133**

Total Voltage Drop from Panels to CBs in an Array		399.1329114	V
Percentage of Voltage Drop Per CB		1.88%	20 CBs
		1.77%	2 CBs
	Average	1.87%	

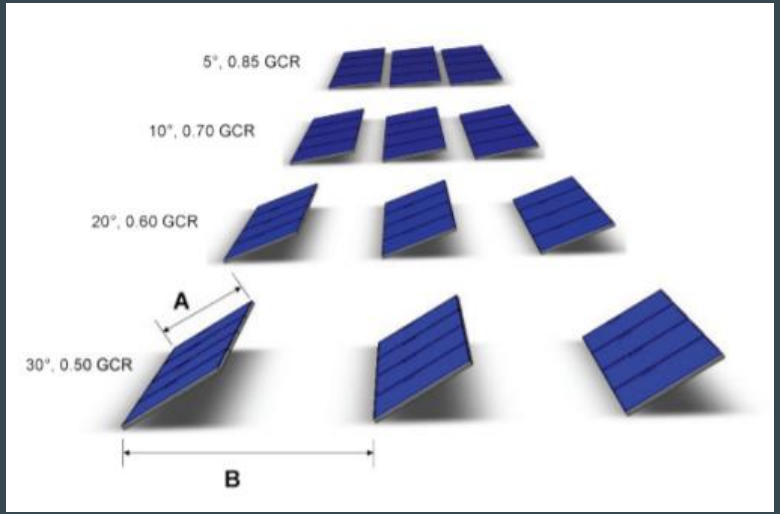
Voltage drop for branch
percent
0.52%
0.27%
0.11%
0.04%
0.04%
0.11%
0.27%
0.52%
0.52%
0.27%
0.04%
0.04%
0.11%
0.27%
0.52%

Ground Coverage Ratio

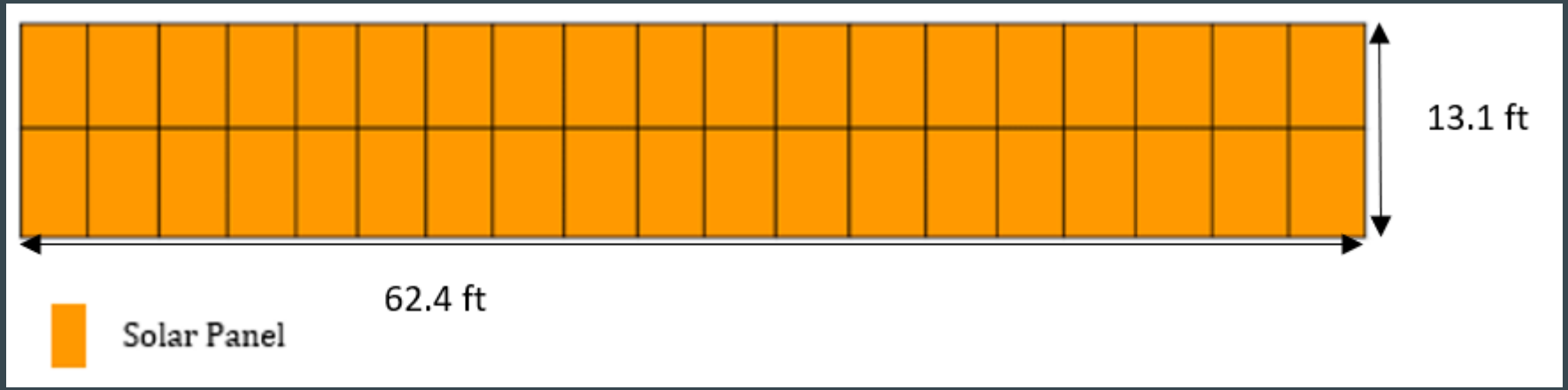
Row space = height of rack + tan(tilt angle) = 13.65 ft

Pitch = height of rack + row space

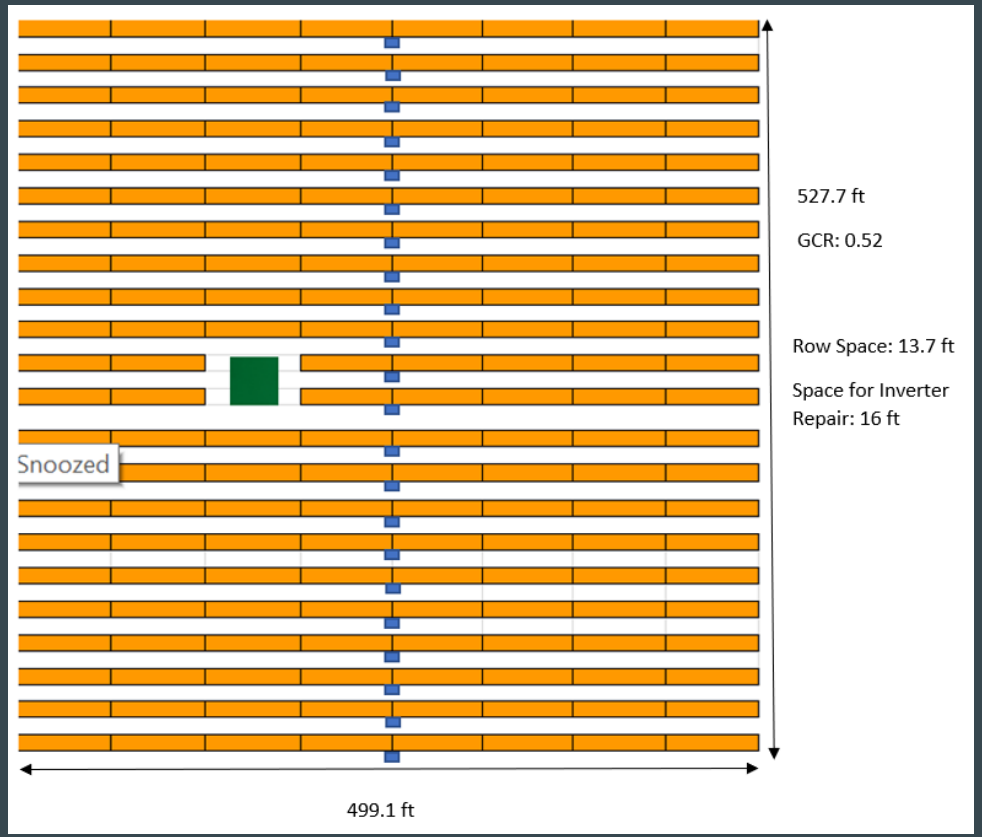
GCR = height of rack/pitch = 0.52

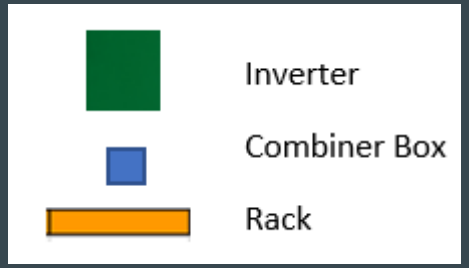


Single Rack Layout: 2x19 Solar Panels

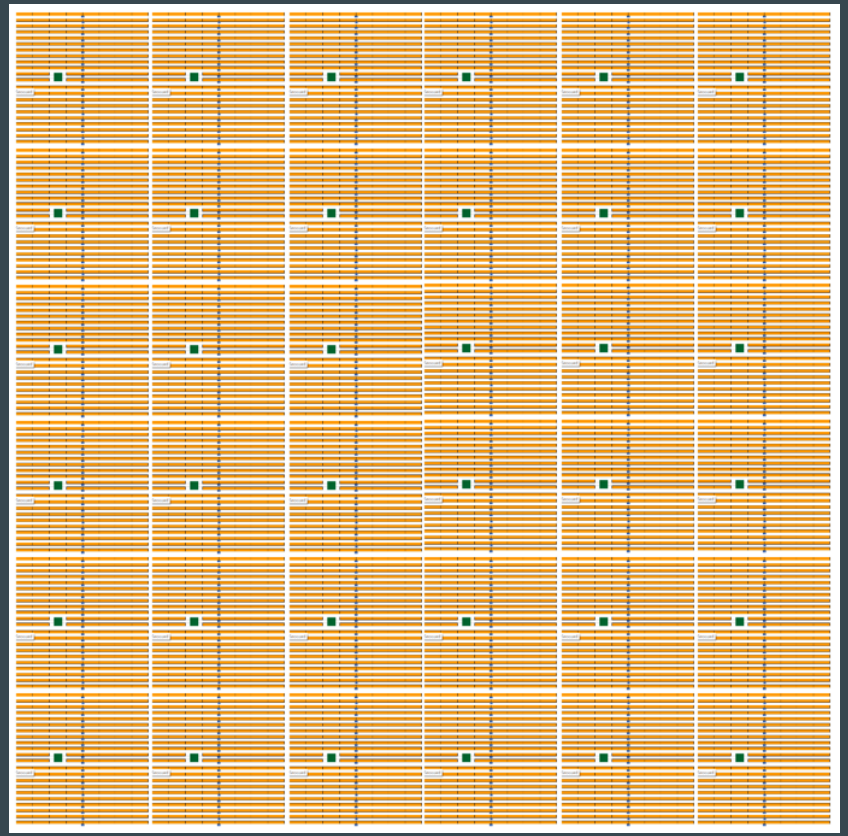


Single Array Layout: 8x22 Racks With 2 Removed, 1 Inverter, 22 CBs, ILR: 1.29





Solar Plant Layout: 36 Arrays, 36 Inverters

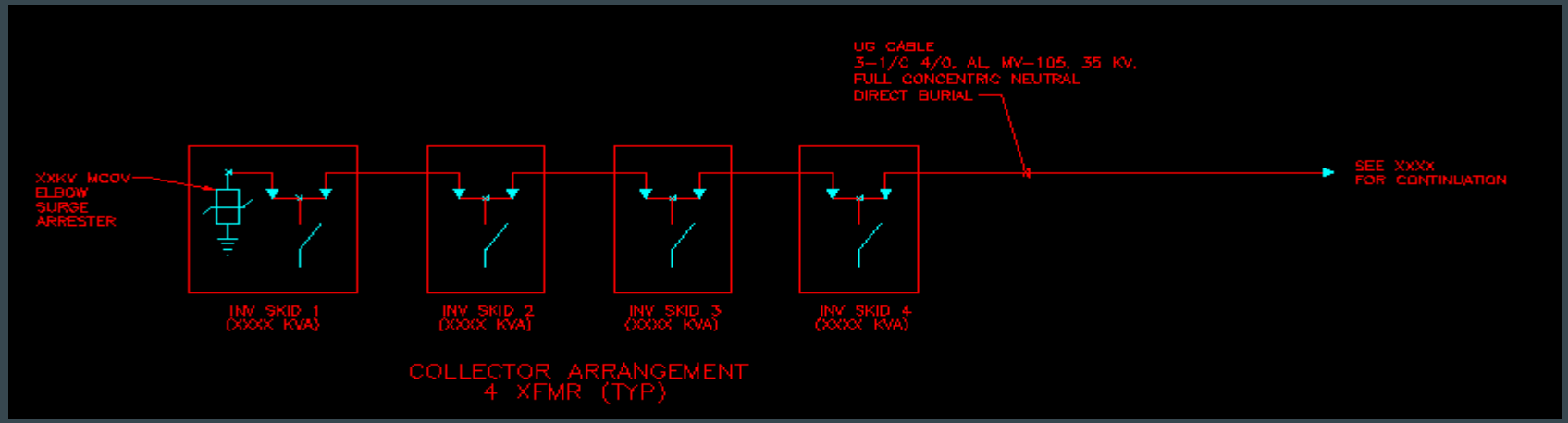


Solar Plant Cost				
Panels	238032	48.558528	million $	
CBs	792	1.01420352	million $	
Inverters	36	15.556275	million $	
Land	233.7919607	0.195	million $	560 acres
	Total Cost	65.32400652	million $	

Collector

Collector Arrangement

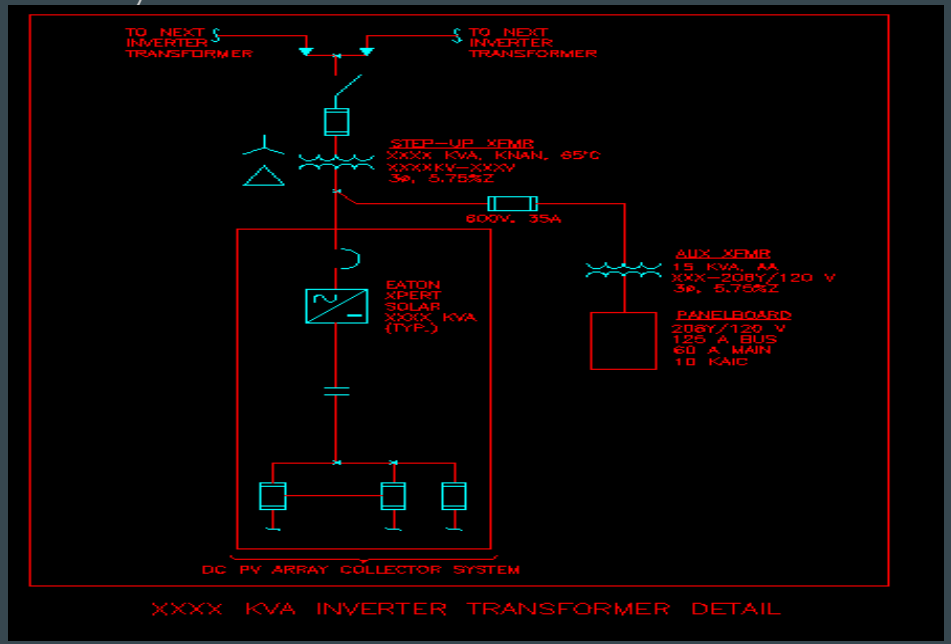
- Collect the output from the inverters and transformers (inverter skid)
- Each inverter has a step-up transformer attached to it.
- It sum up all the skids output and deliver it to the 3 bus feeder



Collector

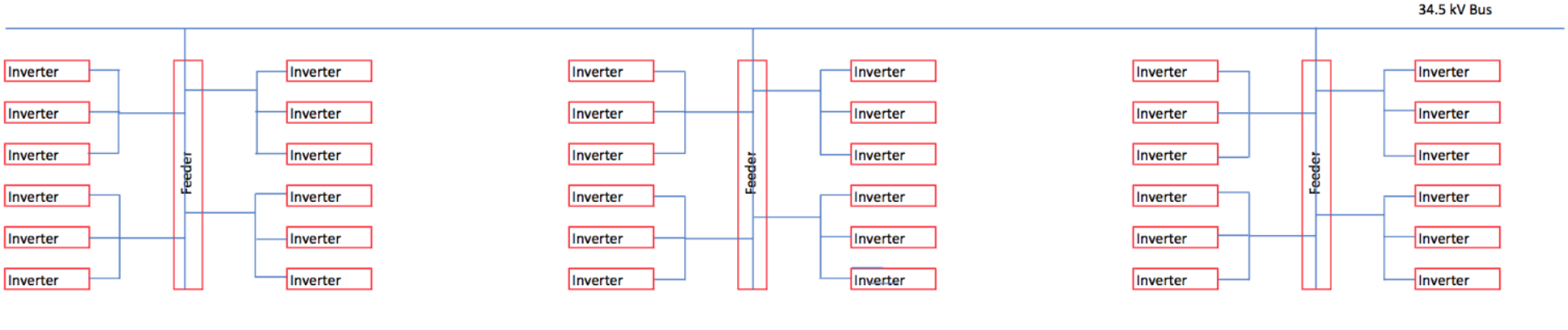
Inverter skid details:

- Combiner box coming from the solar array
- Inverter DC to AC
- An attached step-up transformer



Feeder

- Output of collector
- Input to 34.5 kV bus.
- 4 terminal feeders, each terminal has a 22kV surge arrester and a switch.
- 3 feeders.


34.5 kV Bus
Inverter
Feeder

Questions That We Have

- The value of power per rack that we got from the voltage drop calculation does not match the calculation from the array parameter tool, did we input the values wrong for vmp and imp?
- What is DCB whip wire referring to?
- Why did you use 500 to calculate the rack harness resistance?

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=ROUND(E4*G4/500,3)
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- Are the collector arrangements 4 per collector or we have to figure out our own arrangement?
- Can you explain the feeder drawings?