

EE 491 – sdmay19-26

115kV / 34.5kV SOLAR POWER PLANT/SUBSTATION DESIGN PROJECT

Week 5 Report

Monday (10/1/2018) – Sunday (10/7/2018)

Client: Black & Veatch

Advisor: Venkataramana Ajjarapu

Team Email: sdmay19-26@iastate.edu

Team Members:

Katayi Katanga – Team/Communication Leader

Nur Shuazlan – Meeting Scribe

Yao Cheah – Website Manager #1

Ahmed Sobi – Layout Designer #1

Chufu Zhou – Website Manager #2/Layout Designer #2

Tam Nguyen – Report Manager

Weekly Summary:

In this week, we had a meeting with our client, and we talked about three best locations for our solar power plant in Texas, California, and New Mexico, combiner box justification, and second draft Gantt chart. Then, we divided into three groups to design three different layouts for Estancia, NM and write a write-up about choosing Estancia, NM as the optimal location for our solar power plant.

Summary of Client Meeting:

- Ahmed did safety moment.
- Compared two pieces of land in California as possible locations for solar plant. Choices were Millville, Shasta County (\$375,000), CA and Barstow, San Bernardino County, CA (\$499,000). Final choice was Barstow based on land available, as Millville required a space of 360 acres while only 320 acres were available for sale.
- Compared land in NM for solar plant. Choices were 307 Hwy 419, Sabinoso, New Mexico (307 acres) \$119,000 and 0 Peacock Rd Estancia, NM 87016 (560 acres) \$195,000. Then, the final choice was Estancia, NM.
- Compared two locations in TX based on land price, size and solar radiation as well as weather conditions. The two locations were Plains, Yoakum County, Texas (\$231,000 for 385 acres) and Alpine, Brewster County, Texas (\$147,000 for 285 acres). We assumed 30 acres for the substation and based on these factors, and we chose Alpine as our TX location.
- Justified the use of the Eaton CCB_36 over the Ingecon StringBox based on number of string, size and overall system protection. We will review the CB to be used because new project specs have been included. We now have a limit of 250A for our CB.
- Final solar plant location was chosen based of the following factors: Solar radiation, Total cost of project + land cost, Sunny days in a year, Distance to human settlement, and Space

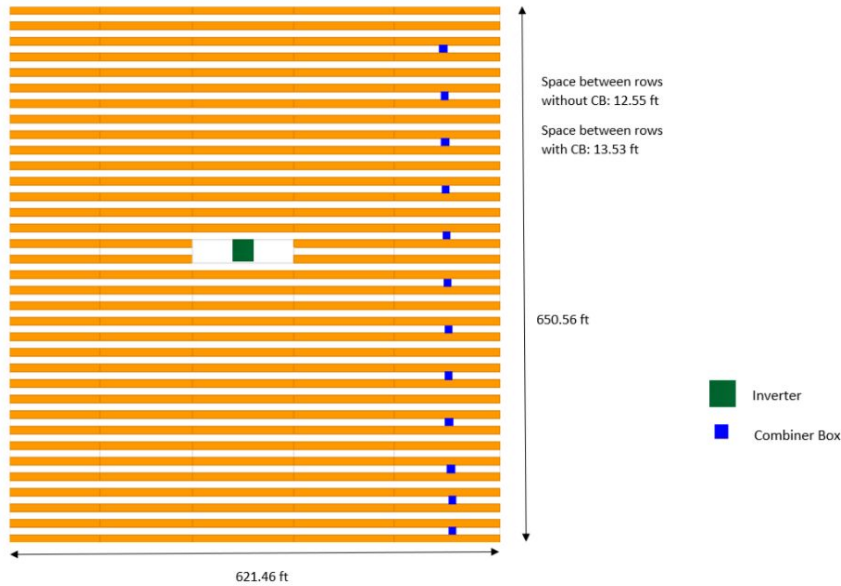
for expansion. Then, the client want us to create 3 different layouts for final location, and send a write up explaining why and how choice was made.

- Lastly, improved gantt chart was presented showing projections of hours spent on tasks.

Past Week Accomplishments:

Katayi and Nur:-

- Solar array plant layout for Estancia
5x35 racks with 2 removed, 12 CBs, 1 inverter



- Total cost of solar plant and size

Solar Plant Cost				
Panels	236664	48.279456	million \$	
CBs	432	0.55320192	million \$	
Inverters	36	15.556275	million \$	
Land	348.2920827	0.195	million \$	560 acres
Total Cost		64.58393292	million \$	

- Worked on the write up explaining why estancia was chosen and the factors which aided in location selection
- Did research on other solar projects in NM and the benefits of building a solar plant in NM

Pros

- 30% federal incentive extended to 2019
- Average grid electricity costs (\$0.12 per kilowatt-hour) make solar viable
- Rising electricity costs (+9% in the last 5 years)
- Good state financial incentives (#8 out of 50)
- Excellent policy scores: interconnection (A) | net metering (B)
- Much higher than average sunshine (33.8% above average)

Cons

- Below-average electricity usage (635 kWh per month) means fewer opportunities for savings

Is solar worth it in Estancia, NM? Considering all of the above, we think so for most people. Solar is 22% more cost effective than the rest of the nation and will pay itself back in around 11 years 7 months for a home buyer. We like to see return times (without state incentives) under 20 years.

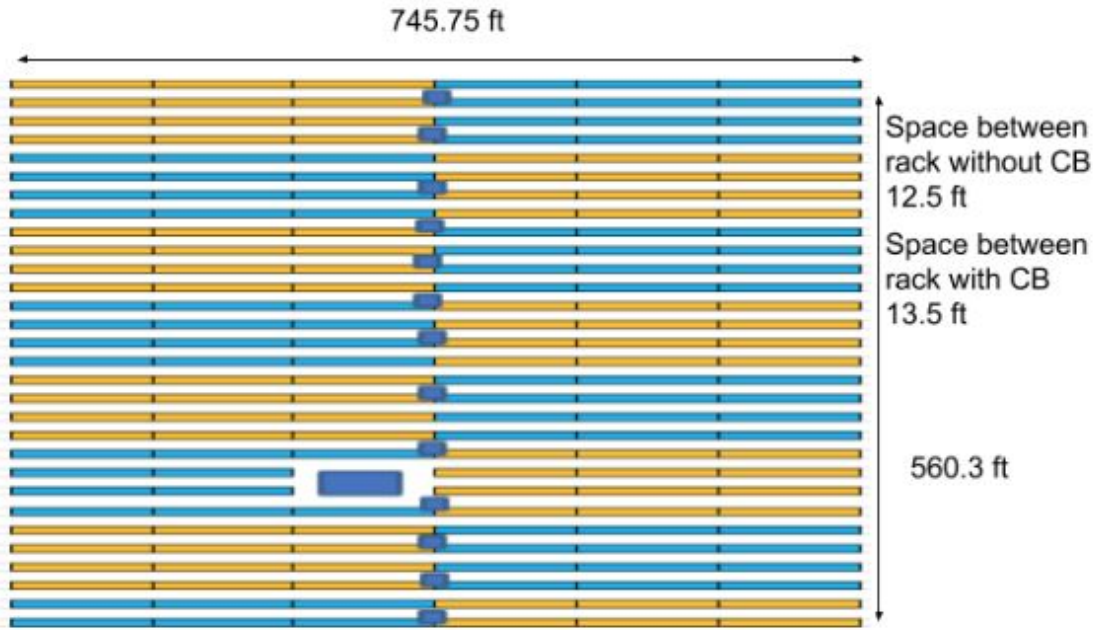
Sources

- *Electricity costs, rates of change, and usage from [EIA.gov](#)*
- *Subsidies analyzed by [DecisionData](#) from state websites*
- *State policy scores come from [freeingthegrid.org](#)*
- *Sun data assumes equal zip code weight based on [NREL](#) data*

Developer Name	Project Name	Location	Capacity	Technology	Sub Technology	Website
SunEdison	SPS- Jal	New Mexico	10 MW	Photovoltaic (PV)	Crystalline Silicon Photovoltaic	--
SunEdison	SPS- Lea	New Mexico	10 MW	Photovoltaic (PV)	Crystalline Silicon Photovoltaic	--
First Solar, Inc.	Cimarron I Solar Project	New Mexico	30 MW	Photovoltaic (PV)	Thin-Film Photovoltaic	http://www.firstsolar.com/Pr...

Ahmed and Tam:

- 6x30 solar array layout for Estancia, NM

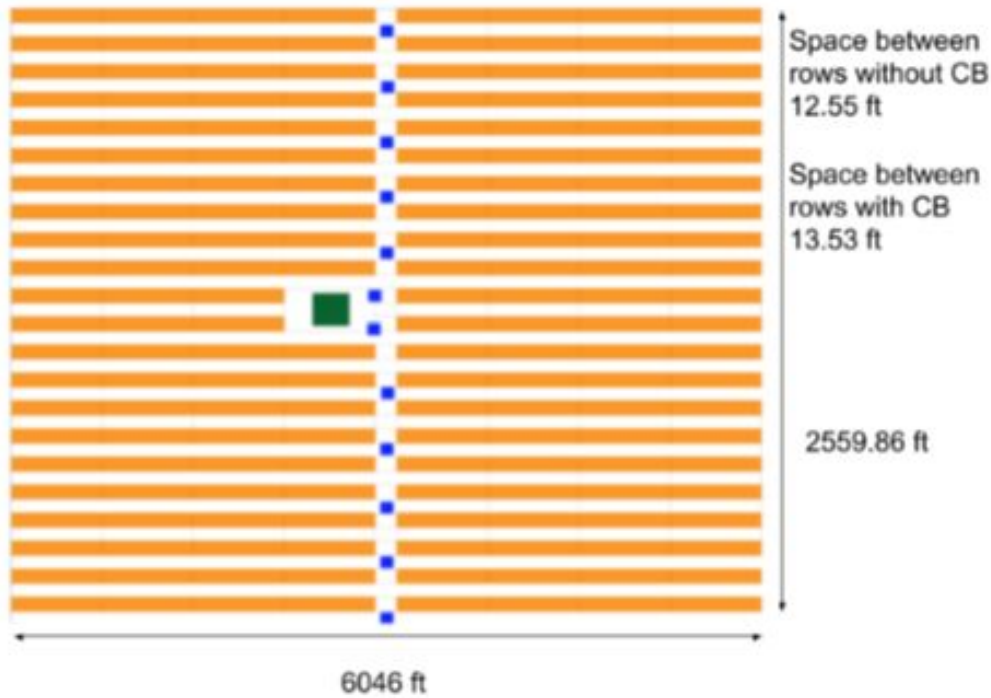


Solar Plant Cost				
Panels	238032	48.558528	million \$	
CBs	288	0.36880128	million \$	
Inverters	36	15.556275	million \$	
Land	357.3509235	0.195	million \$	560 acres
	Total Cost	64.67860428	million \$	

- Worked on the write up explaining why estancia was chosen and the factors which aided in location selection

Chufu and YJ: -

- 8 x 22 solar array layout for Estancia, NM



Solar Plant Cost				
Panels	238032	48.558528	million \$	
CBs	432	0.55320192	million \$	
Inverters	36	15.556275	million \$	
Land	355.3009211	0.195	million \$	560 acres
	Total Cost	64.86300492	million \$	

Pending Issues:

What is the price of inverter?

Will we design the rack system or buy it?

What is the ground coverage ratio?

Will you choose high solar radiation land but expensive or good solar radiation land but cheaper?

Plans For Next Week:

Kat and Nur:

- Redo the solar layout and produce the final system layout.
- Do voltage drop calculations to ensure that we comply

Tam and YJ: -

- Do research on feeder and come up with questions.

Amed and Chufu: -

- Do research on collector and come up with questions.

Individual Contributions

Team Member	Individual Contributions	Hours	Cumulative Hours
Katayi Katanga	Did research on: <ul style="list-style-type: none"> - Other solar projects in Estancia, NM - SolarBOS CB with 250A max current Created/Performed: <ul style="list-style-type: none"> - 5x35 solar array layout for Estancia, NM - Write up for client - Attend all meetings 	12.5	59.5
Nur Shuazlan	Did research on: <ul style="list-style-type: none"> - Other solar projects in Estancia, NM - More about the location(state financial incentive ranking, distance to the nearest town, etc) Created/Performed: <ul style="list-style-type: none"> - 5x35 solar array layout for Estancia, NM - Write up for client - Attend all meetings 	11.5	60
Yao Cheah (YJ)	Did research on: <ul style="list-style-type: none"> - NM location justification - solar project in area - solar radiation and climate Created/Performed: <ul style="list-style-type: none"> - Upload week 4 report on website 	8	41.5
Ahmed Sobi	Did research on: <ul style="list-style-type: none"> - NM location justification - solar project in area 	12.5	47

	<ul style="list-style-type: none"> - major cities near the location - solar radiation and climate <p>Created/Performed:</p> <ul style="list-style-type: none"> - solar layout for the location - cost determination - attended all meeting 		
Tam Nguyen	<p>Created/Performed:</p> <ul style="list-style-type: none"> - 6x30 solar array layout for Estancia, NM - Write up for client - Weekly report - Meeting Agenda - Attend all meeting 	9	42.5
Chufu Zhou	<p>Did research on:</p> <ul style="list-style-type: none"> - NM location justification - solar project in area - major cities near the location - solar radiation and climate 	4	33

Team Hours: 57.5

Cumulative Team Hours: 283.5