

BI-WEEKLY REPORT 6

MARCH 29, 2021 – APRIL 12, 2021

SDMAY21-37

115/34.5KV SOLAR POWER PLANT & SUBSTATION DESIGN

CLIENT: BLACK & VEATCH

FACULTY ADVISOR: DR. VENAKATARAMANA AJJARAPU

GROUP MEMBERS:

CHRISTOF BARRIER

LOGAN HINKLE

KEVE HUGHES

BRIAN LEMKE

CORTLAND POLFLIET

NOLAN ROGERS

ERIC SCHULTZ

SUMMARY

The objective for this report period was to use the notes provided by our mentors to continue work on our grounding diagram and calculations as well as wrap up our bus calculation analysis. Our initial bus calculation looks good so far, and we were correct in omitting calculations concerning the force of ice, given our location of New Mexico. Grounding calculations are a little rough, still need clarification regarding a certain value “ n_d ” and D_m . Still need to experiment with different grounding configurations. Need to finish and polish reports for all calculations. We showed B&V our progress with the DC battery calculation and received some notes. Finally, we completed our first attempt at a conduit diagram, along with being introduced to our AC calculation.

ACCOMPLISHMENTS

- Trench Fill Tool – Nolan, Brian, Cortland
 - Began implementing data obtained from B&V
 - Was initially confused on how to implement, but we currently have a working version for review.
 - Looks good so far, just need visual polishing and an accompanying report.
- Bus Calc – Eric, Christof, Nolan, Brian
 - Created initial attempt with a revised version, B&V will take an in-depth look
 - Assumptions regarding ice force was correct
 - Clarified that this is more of a “sanity check” to make sure our system is working properly so far.
- DC Battery Calculation – Eric, Nolan, Keve
 - We gathered data sheets on SEL relays that pertain to our project.
 - Correct assumption for “worst-case” tripping situation (3 low-side and 1 high-side breakers trip).
 - Calculations are looking great; battery string and cell sizes look good to go.

- Grounding Diagram and Calculation – Eric, Christof, Logan, Brian
 - Heavily revamped the grounding analysis, decided on 12 ft conductor spacing
 - Changed length of grounding rods from 50 to 20 ft for feasibility.
 - Redefined n_d to be 1, we forced our calculated voltages under our tolerance using a ridiculous number of grounding rods (278).
 - Verified that our results will likely be skewed due to lack of intensive grounding programs.
- Conduit Plan – Eric, Nolan
 - Updated routing of cable trench.
 - Sized our conduits using trench fill tool.
 - Included tables listing the specific type and number of conductors per conduit.
- Testing
 - After discussing with B&V, we decided that our “testing” will simply be comparing results with past groups and confirming that our calculations are feasible.

Group Member	Bi-Weekly Hours	Cumulative Hours
Christof	20	79
Logan	4	47
Keve	5	51
Brian	16	66
Cortland	8	48
Nolan	18	69
Eric	24	90

PENDING ISSUES

- Trench Fill Tool –
 - Still need to work on appearance.
 - Awaiting feedback from mentors.
 - Need to create report for this tool.
- Bus Calculation –
 - Need feedback regarding certain assumed constants.
- DC Battery Calculation –
 - How do we describe the size of our battery from this report?
 - Slight confusion to be cleared up.
- Grounding Diagram and Calculation –
 - Still awaiting final confirmation from one of our B&V mentor’s colleagues.
 - Still seems infeasible with the number of ground rods that we have (278).
 - Need verification regarding conductor sizing and spacing.
- Conduit Plan –
 - What is the max size of PVC pipe that we can use?
 - Some cables have quite wide diameters.

PLANS FOR UPCOMING WEEKS

- Trench Fill Tool –
 - Polish appearance and finalize report.
- Bus Calculation –
 - Finalize values and report.

- DC Battery Calculation –
 - Determine the proper nomenclature for battery sizing descriptions.
 - Finalize report.
- Grounding Diagram and Calculation –
 - After receiving more information, finalize design of grounding grid and include however many grounding rods as necessary to meet our tolerances.
 - Start and finalize report.
 - Finalize grounding diagram.
- AC Calculation
 - Final deliverable for this semester, need to calculate AC burdens on the system
 - Used for sizing service station and safety switch
 - Need to consider battery charger
 - Considers “worst-case” situation similar to DC calc.
 - Need to create a report for this calculation like the others.

SUMMARY OF MEETINGS

We received many new resources and very helpful feedback from Black & Veatch over the past two weeks, which has helped fast-track the completion of our Bus Calculation. Many of our other diagrams and calculations are nearing completion, we're at the home stretch! Next few meetings will revolve around the completion of our grounding analysis, as well as evaluating our work with the AC burden calculations. We received word regarding our testing plan, and will begin to implement that wherever necessary. Will meet with faculty advisor and B&V in the coming weeks to go over our final documentation and presentation for review. This has been a great semester for us, we're looking forward to completing this project!