115KV/34.5KV SOLAR POWER PLANT AND SUBSTATION DESIGN

SDMAY23-27 **ADVISOR: PROF. AJJARAPU** **CLIENT: BLACK & VEATCH**

INTRODUCTION

PROBLEM STATEMENT & SOLUTION:

THE US IS MORE AWARE OF ITS CARBON FOOTPRINT, SO TO EXPAND RENEWABLE ENERGY RESOURCES, A UTILITY COMPANY IN ROSWELL, NM, CONTRACTED BLACK & VEATCH TO DESIGN A 60MW SOLAR PLANT AND A 115/34.5KV SUBSTATION. THE UTILITY COMPANY AS WELL AS RESIDENTS NEAR ROSWELL ARE OUR USERS, AND WILL BENEFIT FROM THE INCREASE IN RENEWABLE ENERGY WITHIN THE REGION.

PROJECT OBJECTIVES:

- SELECT A LOCATION, EQUIPMENT, PROTECTION, LAYOUT
- PERFORM CALCULATIONS TO DESIGN AND VERIFY PROJECT
- CREATE DESIGN DIAGRAMS USING CAD AND BLUEBEAM
- SIMULATE DESIGN USING ETAP

DESIGN APPROACH

METHODOLOGY:

OUR PROJECT CONSISTS OF THE SOLAR FARM WHICH WE COMPLETED DURING THE FALL SEMESTER, AND THE SUBSTATION WHICH WE COMPLETED IN THE SPRING.

TECHNOLOGY & TOOLS:

EXCEL, BLUEBEAM, AUTOCAD, ENERSYS, PE GURU, IEEE STANDARDS, ETAP

CHALLENGES:

OUR CHALLENGES MAINLY STEMMED FROM THE FACT THAT THE SOFTWARE AND CALCULATIONS WERE NEW TO MOST OF US SO THERE WAS A BIT OF A LEARNING CURVE TO MOST OF THE PROJECT TASKS.

RESULTS:

TO TEST OUR DESIGN, WE PERFORMED CALCULATIONS AND CHECKED OUR WORK WITH OUR ADVISOR AND CLIENT. THIS ENSURED THAT OUR DESIGNS WERE ALL CORRECT. ADDITIONALLY, WE USED ETAP TO SIMULATE OUR DESIGN AND VERIFY THAT OUR CALCULATIONS WERE ACCURATE.

IMPLEMENTATION:

- SOLAR ARRAY
  - COMPONENT SELECTION
  - ARRAY PARAMETERS
  - VOLTAGE DROP CALCULATIONS
  - SOLAR FARM LAYOUT
  - WIRING AND RACKING
  - COST ESTIMATE
- SUBSTATION
  - ONE LINE AND THREE LINE DIAGRAMS
  - KEY PLAN AND CONDUIT PLAN
  - TRENCH FILL
  - GROUNDING CALCULATIONS AND GRID
  - DC AND AC LOAD CALCULATIONS
  - LIGHTNING PROTECTION
  - BUS CALCULATIONS
  - COST ESTIMATE

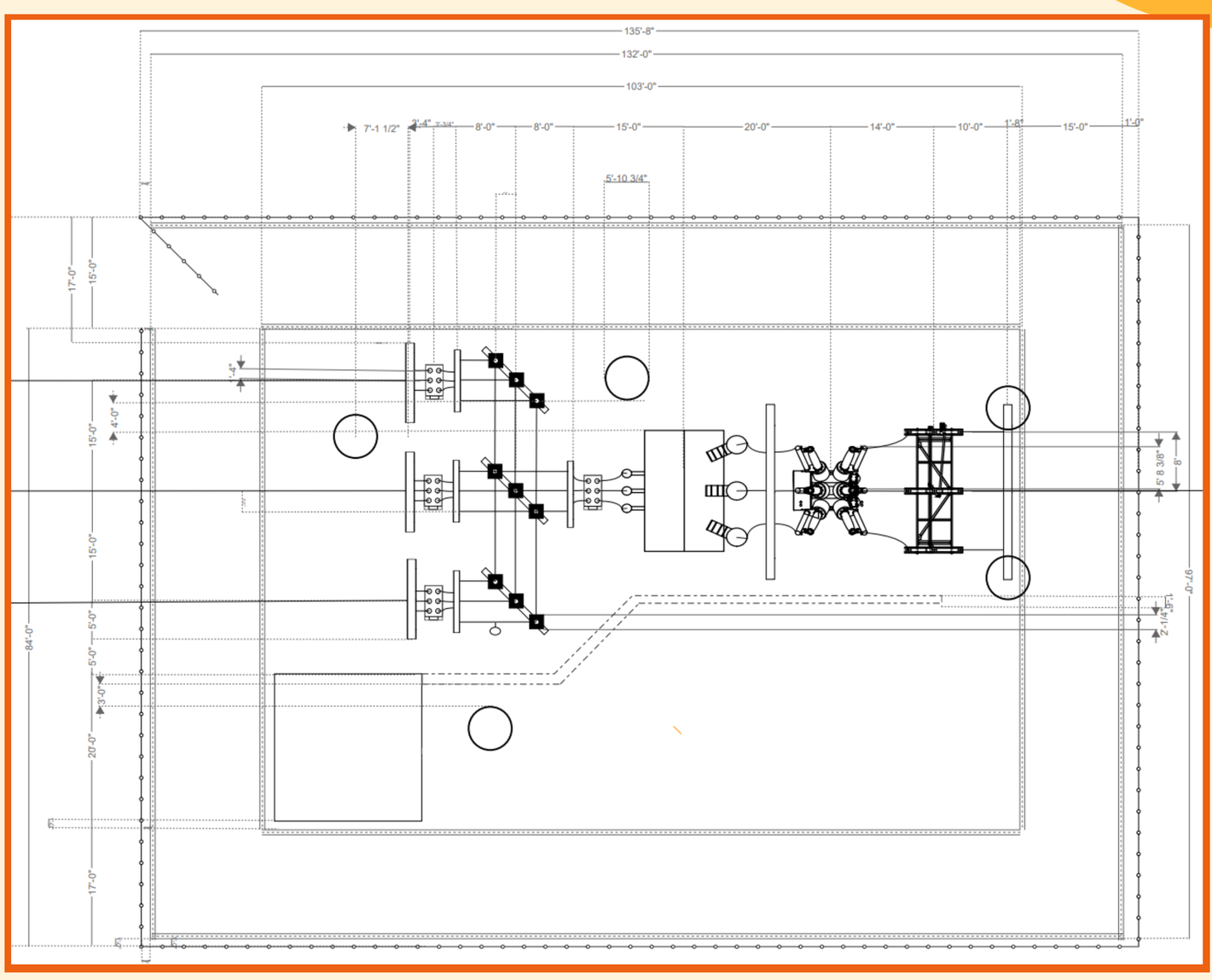
REQUIREMENTS

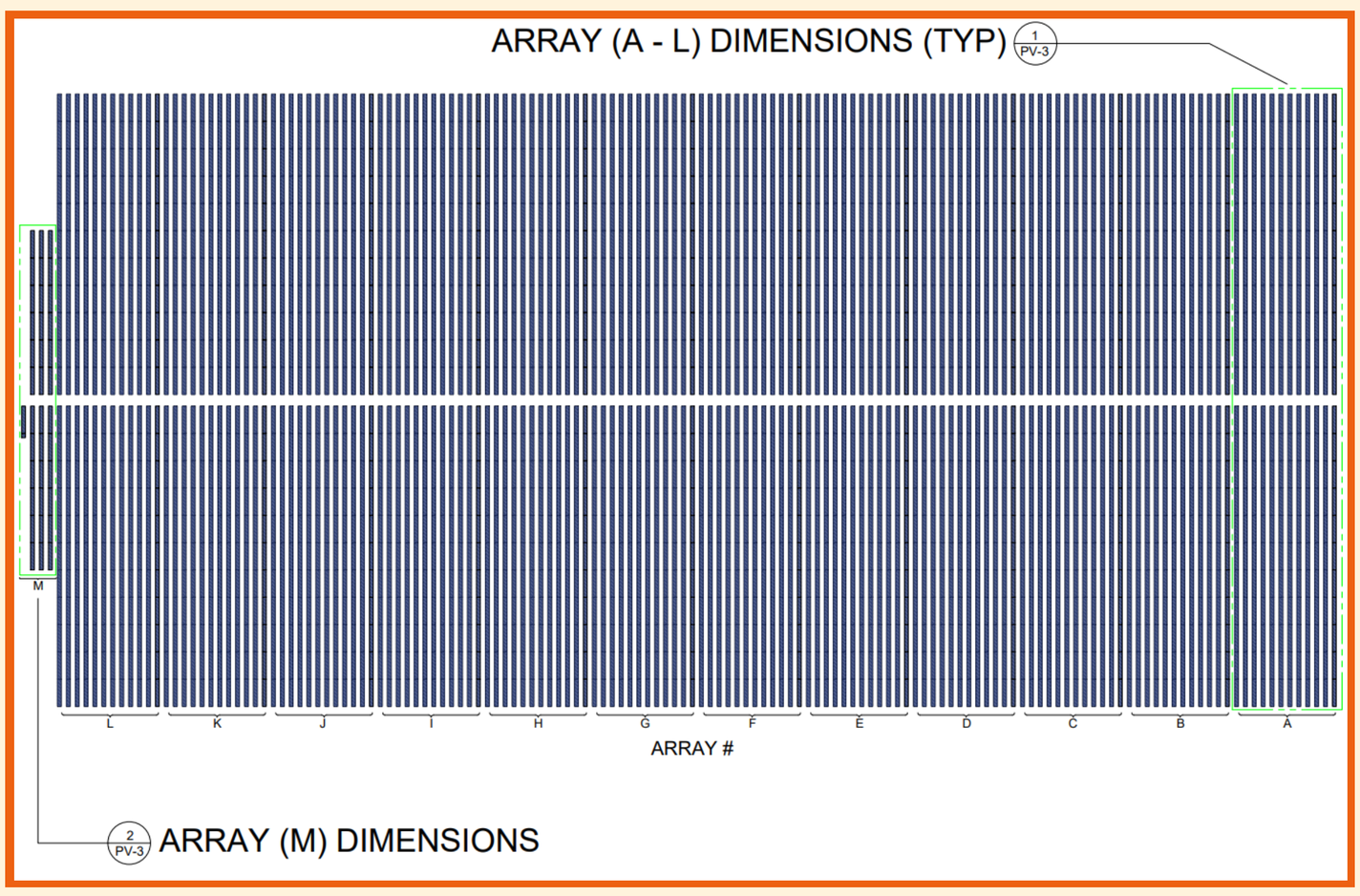
FUNCTIONAL:

- DESIGN A 60MW SOLAR PLANT AND 115/34.5 KV SUBSTATION
- COMPLIES WITH TECHNICAL AND SAFETY STANDARDS SUCH AS ANSI AND IEEE
- DESIGN IS CHECKED BY CALCULATIONS
- DETERMINE LOCATION, EQUIPMENT, PROTECTION, LAYOUT

NON-FUNCTIONAL REQUIREMENTS:

- ECONOMICALLY VIABLE
- PHYSICAL LOCATION HAS HIGH IRRADIANCE, IS DRY, AND IS FLAT
- CLEAR AND CONCISE DESIGN DIAGRAMS





CONCLUSION

IMPACT:

THE IMPORTANCE OF THIS PROJECT RESTS IN ITS POTENTIAL TO IMPROVE THE ECONOMIC AND TECHNOLOGICAL DEVELOPMENT WITHIN ROSWELL, NM. FURTHERMORE, THIS PROJECT ENCOURAGES ENVIRONMENTAL SUSTAINABILITY AND DECREASES DEPENDENCY ON FOSSIL FUELS WITHIN THIS REGION.

TAKEAWAYS & SIGNIFICANCE

DURING THIS PROJECT WE LEARNED HOW TO DESIGN A SOLAR ARRAY AND SUBSTATION FROM THE GROUND UP, WE ALSO BECAME MORE FAMILIAR WITH THE VARIOUS SAFETY STANDARDS AND HOW THEY IMPACTED THE CALCULATIONS NECESSARY FOR OUR DESIGN.

MADISON LAKOMEK, BROOKE NELSON, ASHTON RANDOLPH, JACOB MILLER, JENNA RUNGE, MADISSEN LAWRENCE, ZACHARY ZIMMERMAN, OMER KARAR