SDMAY20-15: BURNS & MCDONNELL SUBSTATION DESIGN

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CLIENT: BURNS & MCDONNELL

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PROJECT STATEMENT

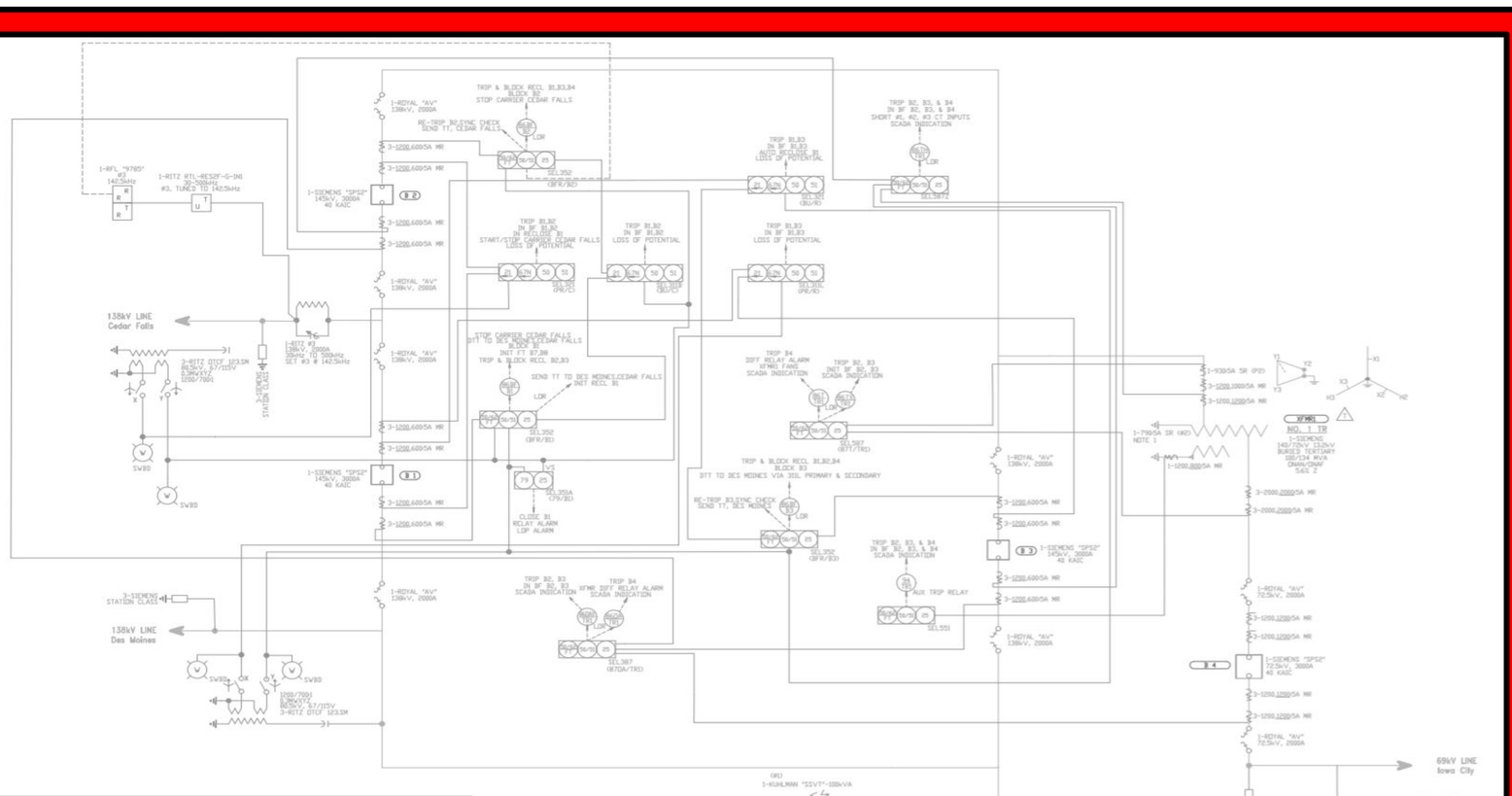
The city of Ames, Iowa requires a new 69/138 kV substation to be designed, and later constructed by Burns & McDonnell. It will serve as an interconnection for a new wind generation farm being built outside the city. The substation must be economically viable and laid out in a way to allow for future expansions of equipment and relaying.

SCOPE

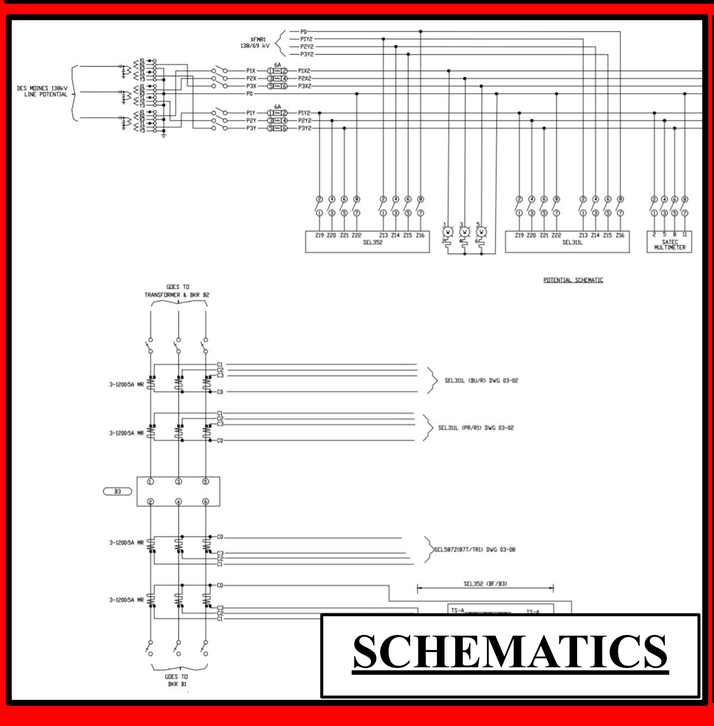
- One-Line Design
- Site Plans & Section Cuts
- Lightning Study
- AC & DC system Planning
- Schematics
- Wiring Diagrams

SYSTEM SPECIFICATIONS

- Ring Bus Configuration for 138kV
  - 3-138kV Gas Circuit Breakers
  - 2-Line Exits
- 1-138kV to 69kV Transformer
- 1-69kV Line exit
  - 1 69kV Gas Circuit Breaker



ONE-LINE DIAGRAM



SCHEMATICS

DESIGN PROCESS

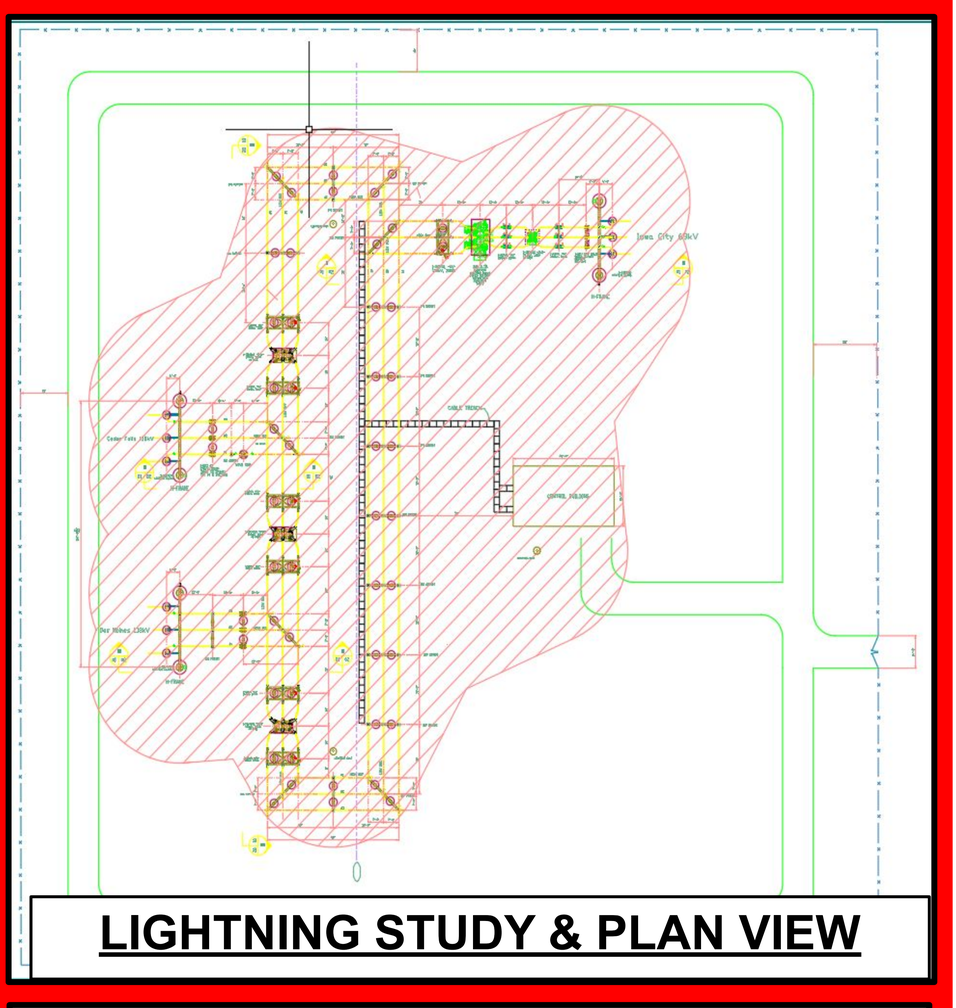
· Assess what needs to be accomplished within the scope of project.

· Delve into the resources provided from client in order to extract useful information, seek further resources if needed.

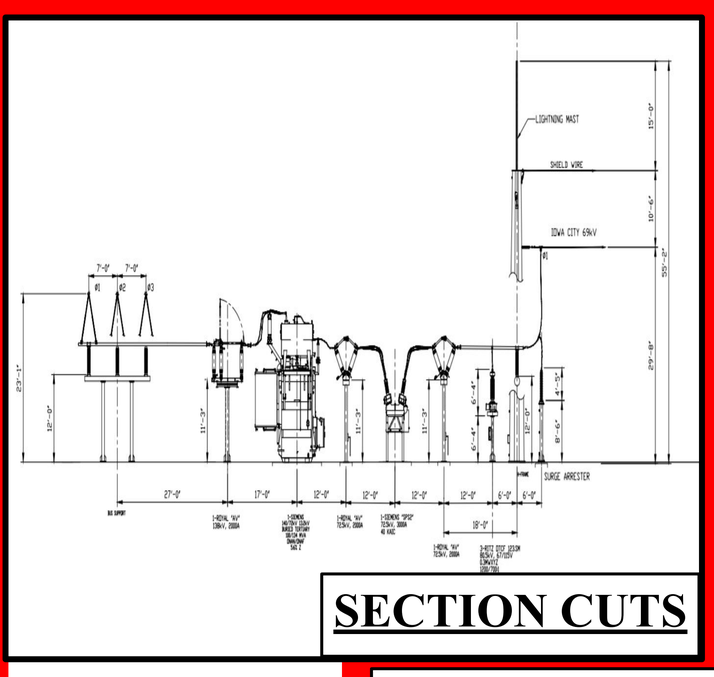
· Generate drafts based on trial and error trial which meet the requirements of our scope based on examples provided.

· Submit rough draft to Burns & McDonnell for review.

· Receive feedback and make necessary changes to meet all parameters in the scope and client's expectations.



LIGHTNING STUDY & PLAN VIEW



SECTION CUTS

CONCLUSIONS

For this project, our senior design team has completed the grounding design, physical design, and lighting protection design. In addition, all calculations were presented for this study to verify the number of the masts that will be required to be added to guarantee all equipment is safe in the experience of lightning. This substation will operate as a method of interconnection between a new wind farm (generation plant) and the pre-existing transmission system.

RESOURCES

Design Guide for Rural Substations

Substation Basics Burns & McDonnell

ENGINEERING STANDARDS AND DESIGN PRACTICES

- IEEE 485-2010 Recommended Practice for Sizing Lead-Acid Batteries for Stationary Applications
- IEEE 998-2012I EEE Guide for Direct Lightning Stroke Shielding of Substations

ACKNOWLEDGMENT

We would like to acknowledge and thank Burns & McDonnell for their assistance in our project, technical advice, and for providing documentation of which we have used as reference in our design process.