Project Plan for May 1611

Designing Optimal Distribution System Upgrades for Reliability and Growth in Lamoni,IA

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Introduction

Problem Statement

Lamoni is a growing community of 2,300 people in southern Iowa that is served by a municipal utility providing electricity, gas and water to the community. Lamoni would like to work with a team of students to help the utility choose the most cost-effective way to upgrade its distribution system to the east, and also the most cost-effective way to loop a distribution feeder that is currently providing radial service. Among the design elements are: route selection, lack of breaker space in the substation, moving breakers, switching voltage on existing feeders, and possible consideration of incorporating some smart grid elements into the design of the updated system. Lamoni will provide one-line diagrams of current feeder configurations, data on power flows, design specifications of existing system and telephone support for questions from students.

Project Statement

Lamoni is powered by a substation rated for 10MW. A feeder from the substation sends power out to the east end of Lamoni and is becoming overloaded. To relieve this issue, an underground radial line will be routed to help distribute power along with an existing overhead line. If the underground cable can support the full load, the overhead line will be removed. The power line specifications and load data will be supplied by the Municipality for us to verify that the lines will be able to support the full load through a power flow analysis. The project team will also need to locate a viable route for the new underground radial line.

Deliverables

1) A report suitable for presenting to the utility governing body detailing the design recommendations, power flow analysis and cost analyses (net present worth of alternatives)
2) A timeline for the upgrades, suitable one-line drawings, distribution line routing plan, and equipment specifications

System Requirements

Project Requirements

The project is to upgrade a distribution system that feeds power to the city of Lamoni, Iowa. They are looking for a system that minimizes cost to the city. We would like to create a couple of options that would help an existing overhead line supply a 2MW peak load to the east side of Lamoni. The client would like the system to be as reliable as possible, to do such we would need to make a looped system. We will need to also identify a viable route for the options we present and create a cost analysis. At the end of the project we will be given the chance to present our design options to the City Council.

Assessment of Proposed Solution

The study will provide the most efficient and cost effective way to develop a distribution line that goes to the east side of the city. We will also try to limit how much labor cost the city will have to hire/pay for installation and implementation. We understand that underground lines cost much more than overhead lines, but they are generally more reliable and visually pleasing to locals. Underground lines are more reliable because they are less vulnerable to faults than overhead lines. This system will also need to be clear of any obstacles for routing purposes. This project will allow the substation to split its load and allow for the substation to support more load, which will help the growth of the city and its outer limits.

Validation & Acceptance Test

Considering that this is a case study, we will be submitting our finalized report to Lamoni's engineering firm to review and further validate our project. We will be utilizing computer programs and actual load data to verify our design.

Interface/System Description

Content

We will be providing a report to the Municipality containing our suggested engineering drawings, cost analysis, and power flow analysis. The engineering drawings are created in Microstation and will detail a one-line of the remodeled substation. A cost analysis will be created based upon the current market price of the suggested materials by the Municipality. We will be able to create a power flow analysis based upon the load consumption data provided by the Municipality.

Technical Approach

- Analyze the load demand data of the feeder
- Locate a good route for the new underground line
- Verify the capacity of the overhead and underground lines. Check to see if the load can be supplied by an all underground radial line
- Determine whether any breakers will need to be added for the new radial line
- Update the substation one line diagram with our design
- Perform a power flow analysis
- Perform a cost analysis
- Research smart grid elements and their applications

Process Details

After performing all of the necessary calculations for the power flow analysis, we will be able to create a one-line of our proposed system. These documents will be compiled into a report which we will present to the utility governing body. The report will include supporting documents of the power flow analysis, cost analysis and one line diagrams.

Test Plan

We will be able to verify our design specifications against the load demand information provided by the Municipality. As long as the rated capacity of our overhead and underground lines can support the peak demand, our design should be valid. Our design will be further validated by Lamoni's engineering firm when we submit our report.

Work Breakdown Structure

Project Schedule

Task Name	Week of	Resource Names	Notes
Meet with Adviser	**Every Friday**	**Anne Kimber**	**Meeting to talk about current and future tasks. Introduced the team.**
Design Outline	**9/14**		
Contact Emil	**9/21**	**Emile Segebart**	**Discuss the project constraints, ask for CAD and load demand files**
Create Senior Design Website	**9/28**	**Tristan Cox**	**Create website and upload documents**
Project Plan V1	**10/2**		**Create first draft of the project plan.**
Contact Lamoni Engineering	**10/5**	**Scott Hardy**	**Received email with specifications of the one lines.**
Design Document V1	**10/20**		
Visit Emil in Lamoni	**10/23**	**Emil Segebart**	**Meet in person to discuss project details and possibly see the site.**
Define Options for System	**10/25**		
Analyze Load Demand Data	**11/1**		
Project Plan V2	**11/11**		
Presentation to Senior Design Class	**11/11**		**Practice run for the end of semester presentation.**
Create One Line	**11/18**		
Design Document and Project Plan Submission	**12/3**		**Hand in work for the semester. One line diagram, route study, and cost analysis.**

End of Semester Presentation	**12/7 - 12/11**		**Present to faculty.**
Perform a Load Study	**Second Semester**		
Determine Line Routing	**Second Semester**		
Create a Cost Analysis	**Second Semester**		
Write the Report	**Second Semester**		
Submit Report to Adviser for Review	**Second Semester**		
Submit Report to Lamoni Municipality	**Second Semester**		

Risks/ Feasibility Assessment

Because this project revolves around an existing process, our design will be very feasible to implement. The Lamoni Municipality will be submitting our report to a professional engineering firm to review/ revise before implementation. This is necessary because this system will be around for years and will need to be reliable for the people of Lamoni. The review of the engineering firm will mitigate the risk of any possible design defects. Another risk might include the routing location of the underground line. We need to make sure that we pick a route that will avoid any obstacles. If a poor route is chosen, it could result in line faults and longer response time. We will also want to make sure that our design leaves room for future additions to the system.

Cost Considerations

Because our project is design based, there are no real costs for our project team. By the end of our project, we will have a written report with our design suggestions along with data to validate our conclusions. There will be a cost associated with the implementation of our project if the Municipality decides to construct our design. The construction cost will likely be in the hundreds of thousands - if not millions- of dollars and will be included in the report once we have determined the value.

Market/ Literature Survey

Our design is an improvement to an already existing product. This will help us create a cost analysis by allowing us to see what other similar designs cost. There are also a lot of knowledgable people in this industry that can help us with our design, such as Scott Hardy from the engineering firm that works with the Lamoni Municipality. He will be a valuable resource for us when we start to get into the details of the design.

Conclusion

In conclusion, we will be designing a system upgrade for the city of Lamoni, IA. The city is currently being powered by a 10MW substation with an overloaded feeder to the east side of Lamoni. To relieve this issue, we will be adding an underground radial line to help distribute power along with an existing overhead line. If possible, we would like to remove the overhead line and have the underground line supply the entire load. The data on these lines will be supplied by the Municipality for us to verify that they can support the load through a power flow analysis. The project team will also locate a viable route for the new underground radial line. Taking into account cost efficiencies, we will compose a report detailing our design and providing our calculations. Along with this report, we will submit one line diagrams and power flow analysis to the Municipality of Lamoni for further review.