IOWA STATE UNIVERSITY
College of Engineering

4910 Lightning Talk: Problems & Requirements

Sean Carver, Bethany Danley, Thomas Edwards, Nathan Kallal, Mina Khalil, MacKenzie Woods

Project Overview

- Client: Burns and McDonnell
- User: ISU Utilities and customers
- Goals:
  - Model and analyze the ISU Microgrid
  - Increase reliability for end users
  - Design upgrades for both transmission and distribution power systems
  - Create future plans for load growth and increase of renewable energy

Problem Statement

We are tasked with designing/modeling an upgraded and modernized electric distribution microgrid for Iowa State's Campus.

We need to provide a comprehensive and easy to understand model for both the distribution grid and substation, as well as documents detailing the evidence and data we used to create our upgrade plans and models

User Needs

Iowa State Utilities

- ISU utilities needs a reliability plan and list of possible upgrades
- Cost estimates for adding renewables energy sources lik solar panels and wind turbines
- List of upgrades made for future load growth and weather load can be added
- Overall cost estimate for all proposed actions

Landowners in the Area

- Location of renewable energy sources

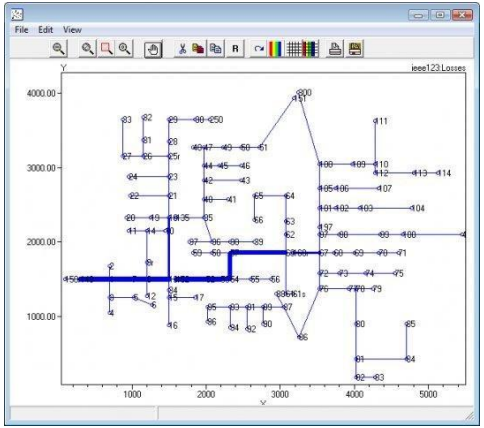
Students, Staff, etc.

- Cost shedded on to them for system upgrades

Requirements

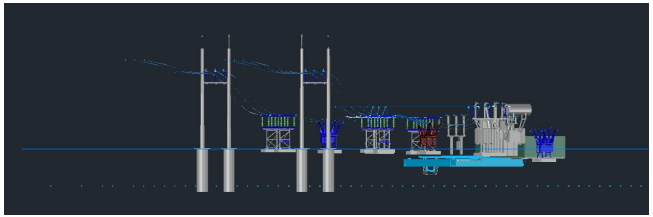
Easy to Understand Models/Diagrams

- OpenDSS Distribution Grid Model
- AutoCad Substation Model
- All representations of our system upgrades should be easily to comprehend in a presentable form



Research/Calculations Documents

- Loading calculations and power flow documents/spreadsheets front the distribution team
- Grounding study, fault current calculations for the substation team



Cost Estimates

- Show the cost of each proposed

Engineering Standards Used

Distribution Side:

- IEEE SA - IEEE 2030.9-2019 (IEEE Recommendations for Microgrid Design)
- IEEE SA - IEEE P2030.12 (IEEE Guide for Design of Microgrid Protection Systems)
- IEEE SA - IEEE 1409-2012 (IEEE Guide for Power Quality Improvement)
- IEEE SA - IEEE 1854-2019 (IEEE Trial-Use Guide for Smart-Device Distribution Applications)

Transmission Side:

- IEEE 998 - 1996 (IEEE Guide for Direct Lightning Stroke Shielding for Substations)
- IEEE 1100-2005 (IEEE Recommended Practice for Powering and Grounding Electronic Equipment)
- IEEE 399-1997 (IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis)
- IEEE 493-2007 (IEEE Recommended Practice for the Design of Reliable Industrial/Commercial Power Systems)
- IEEE 1899 - 2017 (IEEE Guide for Establishing Basic Requirements for High-Voltage Direct-Current Transmission Protection and Control Equipment)

Conclusion

All in all, our group is responsible for giving our users a comprehensive report of what upgrades we recommend they make to the campus microgrid and university substation.

Additionally, we need to provide a rough estimate of the cost of these upgrades to our users

Images Used

- Burns and McDonnell Logo:

  https://www.burnsmcd.com/hubfs/BMCD_PR_2017/03/Burns-%26-McDonnell_logo.jpg

- OpenDSS Model:

  https://a.fsdn.com/con/app/proj/electricdss/screenshots/238706.jpg/max/max/1

- AutoCAD Substation Model:

  link

- Iowa State Power Plant:

  https://www.inside.iastate.edu/media/2017/03/0ZQ1.jpg