

UNC Charlotte – Lee College of Engineering Senior Design Program

Senior Design Project Description

Company Name	<i>Duke Energy</i>	Date Submitted	<i>07/3/2019</i>
Project Title	<i>Load Profiles of Customer Classes and Feeder Voltage Profile</i> DUKE_VOLT	Planned Starting Semester	Fall 2019

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills:

Discipline	Number	Discipline	Number
Mechanical		Electrical	3
Computer	1	Systems	
Other ()			

Company and Project Overview:

Duke Energy is one of the largest electric power holding companies in the United States, providing electricity to 7.6 million retail customers in six states. Duke Energy has approximately 49,500 megawatts of electric generating capacity in the Carolinas, the Midwest and Florida – and natural gas distribution services serving more than 1.6 million customers in Ohio, Kentucky, Tennessee and the Carolinas.

Load profiles define the usage curve of a group of customer classes with similar usage shapes. Because of increased deployment of Advanced Metering Infrastructure (AMI), Duke Energy has access to unprecedented granularity of customer data that can be used to evaluate accuracy of existing load profiles and develop more accurate updated ones. Moreover, increased presence of Behind The Meter (BTM) resources, such as solar generation, i.e. rooftop photovoltaics (PV), and battery energy storage, affect the net power demand for those customers, making load profile determination challenging.

Project Requirements:

The senior design team will analyze AMI data for select customer classes, evaluate existing load profiles for those customer classes, and develop updated load profiles accordingly. This study and load profile development would result in a higher level of accuracy in the customer usage model, expected to subsequently improve performance of Distribution Management System (DMS) tools



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and applications, such as power flow, Volt Var Control (VVC), and Fault Isolation and Service Restoration (FISR).

Moreover, the team will investigate effects of increased level of BTM resources (solar generation and battery energy storage) on perceived load behavior and load profiles.

In a second project phase, the team will perform power flow and LVM (ideally using Duke Energy representative distribution feeder/s in DMS), and visualize voltage profile along the feeder. It is desirable that the team develops a script to automate creation of voltage profile plots.

Expected Deliverables/Results:

- Analysis of AMI data with respect to agreed upon measures needed to define load profiles for a customer class
- Evaluation of existing load profiles with respect to AMI data
- Development of updated load profiles
- Report summarizing process used, dataset used, and developed load profiles, including discussion on effect of BTM resources on those profiles
- Power flow and LVM results for representative distribution feeder/s
- Plot of voltage profile
- Script that automates voltage profile plotting (desirable)

Disposition of Deliverables at the End of the Project:

Provide all data to Supporter at the conclusion of the Expo.

List here any specific skills, requirements, specific courses, knowledge needed or suggested (If none please state none):

- Power and energy focus preferred
- Power system analysis course – taken or in progress – preferred
- Knowledge of DMS a plus
- Programming knowledge preferred