**Scope of Work for Fall 2020 SPIR**

1. Create a manual for using OpenDSS to perform snapshot and time-series simulation of Switched Source’s devices : a) the Tie Controller, b) the Phase-EQ
2. The manual should contain generic introduction of 1) how to build various components in OpenDSS.
3. The manual should contain detailed steps of how to run a distribution system model assuming the user has not used OpenDSS before. This should include 1) how to monitor and view parameters, 2) how to run snapshot and time-series simulations
4. The manual should contain details of how to place Switched Sources devices through the MATLAB COM interface. It should include 1) how to correctly configure and place the device, 2) how to run snapshot, duty and time-series simulation of the device. In this section, an introduction should be written about what Switched Source’s devices do and their basic operation.
5. How to take utilities substation measurement and use them to create time-series simulation, how to scale the model properly and validate the model against measurement data.
6. How to perform system analysis for device placement. It should include the steps for 1) optimal location for solar hosting analysis, 2) optimal location for efficiency benefits, 3) optimal location for demand allowance, 4) optimal location for VVO/CVR. The optimality of these should be determined through the use of color gradient mapping. Steps of how to produce these maps should be outlined.

The processes of these are already set with most of the codes built. The intern will start learning OpenDSS while documenting critical modeling and simulations steps for parts a and b. For c and d, the intern will mostly rely on code that is already built, clean the code or build a clean version of already written algorithms. The intern should work closely with the applications engineer documenting their processes for running studies. The intern will serve a critical role in helping to identify and document key steps as a fresh user of the algorithms and processes. The deliverables of the intern will serve two critical purposes 1) provide a starting point for a new intern or a newly hired engineer to get him up the speed understanding basics of modeling our devices and running system studies. 2) Portions of the manual will be split up (part c and d) to be given to utilities who use OpenDSS so they can quickly use our device’s models to run their own studies.

1. Create an automated tool that takes field measurement data for when the device is “ON  
    and for when the device is “OFF” to produce specific sets of KPIs.

The intern will start from the code of part c and e and modify it to create new tools that are capable of taking measurement data, utilizing the model and producing measurements for KPIs which will be determined by Switched Source during this stage of the project. The following are starting point KPIs, some might be removed and others might be added:

1. Minimum and Maximum NEMA voltages across the network during peak demand
2. Minimum and Maximum NEMA current across the network during peak demand
3. Maximum NEMA voltage and Current at the PhaseEQ location and at the substation for time-series data
4. Minimum and Maximum NEMA current and Voltage across the network for Time-Series data
5. Maximum losses across time-series data.
6. Hosting capacity for each PhaseEQ node (colored geographical map)
7. Maximum/Minimum hosting capacity across time-series for all DG placement nodes
8. Maximum demand allowance across time-series for all load placement locations
9. Maximum at certain specific nodes
10. VVO margins for peak demand before and after PhaseEQ

Note: that this work might take the intern 4-12 months depending on the familiarity with OpenDSS. For someone that already knows (intermediate or advanced) OpenDSS, it should take around 4-6 months. For someone without OpenDSS expertise (beginner), it should take around 6-10 months (within 12 months).