Accelerate the Integration of Electric Vehicles in Power Distribution Systems with Data-Driven Planning

Team: Electrify USA. Team Lead: Prof. Nanpeng Yu, University of California, Riverside

Project Summary

Utility Partners' Problem: The increased EV charging load will lead to many issues in the power distribution systems such as deteriorating voltage quality, higher network loss, and overloaded transformers.

Project Objective: Develop an integrated and data-driven planning platform that predicts the feeder level EV adoption, charging profile and impacts on the distribution network (see Figures Below).

Solution Implemented: The data-driven planning platform has 3 modules.
1) EV adoption prediction module using generalized Bass diffusion model
2) EV charging demand forecasting module with LSTM + encoders
3) Assess impacts of EV charging on power distribution feeders by integrating the outputs modules 1 and 2 with distribution system simulation software.

Key Project Members

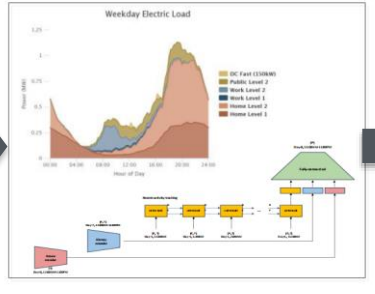
- University of California, Riverside (**UCR**): Prof. Nanpeng Yu (ML),
- Baltimore Gas and Electric (**BGE**): Kristy Fleischmann Groncki and Divesh Gupta (EV)
- Pepco Holdings (**PHI**): Timothy Smith, Vincent Wynne, and Christine Measamer (EV)
- **Exelon**: Po-Chen Chen, Ankush Agarwal, and Timothy Krall (ML)
- **Weave Grid**: John Taggart (ML, transportation)

Impacts and Benefits

- **Short-term**:
  - Optimize feeder operation and improve customer experience
  - Support market participation and enhance operational flexibility
- **Long-term**:
  - Informed decision-making for distribution system upgrade

Task 1: Zip Code / Feeder Level EV Adoption Prediction

Task 2: EV Charging Profile Forecast



Task 3: Analyze Impacts of EV Charging on Power Distribution Grids