SAND2020-2258C

PROJECT NAME: Physics-Based Data-Driven Grid Modelling to Accelerate Accurate PV Integration

Last 5 digits of project number: **34226**

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BACKGROUND / INDUSTRY IMPACT

- Modern distribution analysis tools and algorithms are continually improving (hosting capacity analysis, QSTS, and DERMS), but each uses feeder models based on a manual data entry process that is often out of date and prone to error with little validation or calibration

PROJECT OVERVIEW / OBJECTIVES

- This project will efficiently utilize grid-edge sensing and Big Data to provide a more granular understanding of the distribution system and to substantially increase the precision and accuracy of distribution system models – creating a fundamental shift from models based on manual entry to data-driven modeling

METHODS

- Use physics-based (i.e. non-black-box), data-driven Machine Learning algorithms that allow distribution grid models to dynamically adapt to continuously changing conditions on the grid, increasing accuracy and removing uncertainty from distribution system models to facilitate the installation of high-penetrations of PV.

KEY OUTCOMES / MILESTONES

- Identify customer phase with 100% accuracy, even with measurement noise.
- Detect behind-the-meter PV locations and predict PV size, tilt, and azimuth within 5% accuracy.
- Estimate secondary system topology and line parameters with high accuracy
- Demonstrate the value of higher resolution load data for accuracy in load flow results and hosting capacity by decreasing the hosting capacity error to <50% of the original error on average

CONCLUSION / REMAINING RISK

- This project provides a quantum leap from distribution models based on static data entry to data-driven distribution models that are continuously learning and being calibrated based on grid-edge sensors and advanced, physics-based machine learning algorithms.
- Methods have been proven to be robust to measurement errors and uncertainties.
- The improved feeder models enable business cases including: accurate DER impact assessment, improved distribution system efficiency, better implementation of CVR, etc.

SYSTEMS INTEGRATION TRACK (System Planning Models and Simulation)

Intelligent Calibration of Distribution System Models Using Grid-Edge Sensing to Improve PV Integration Accuracy

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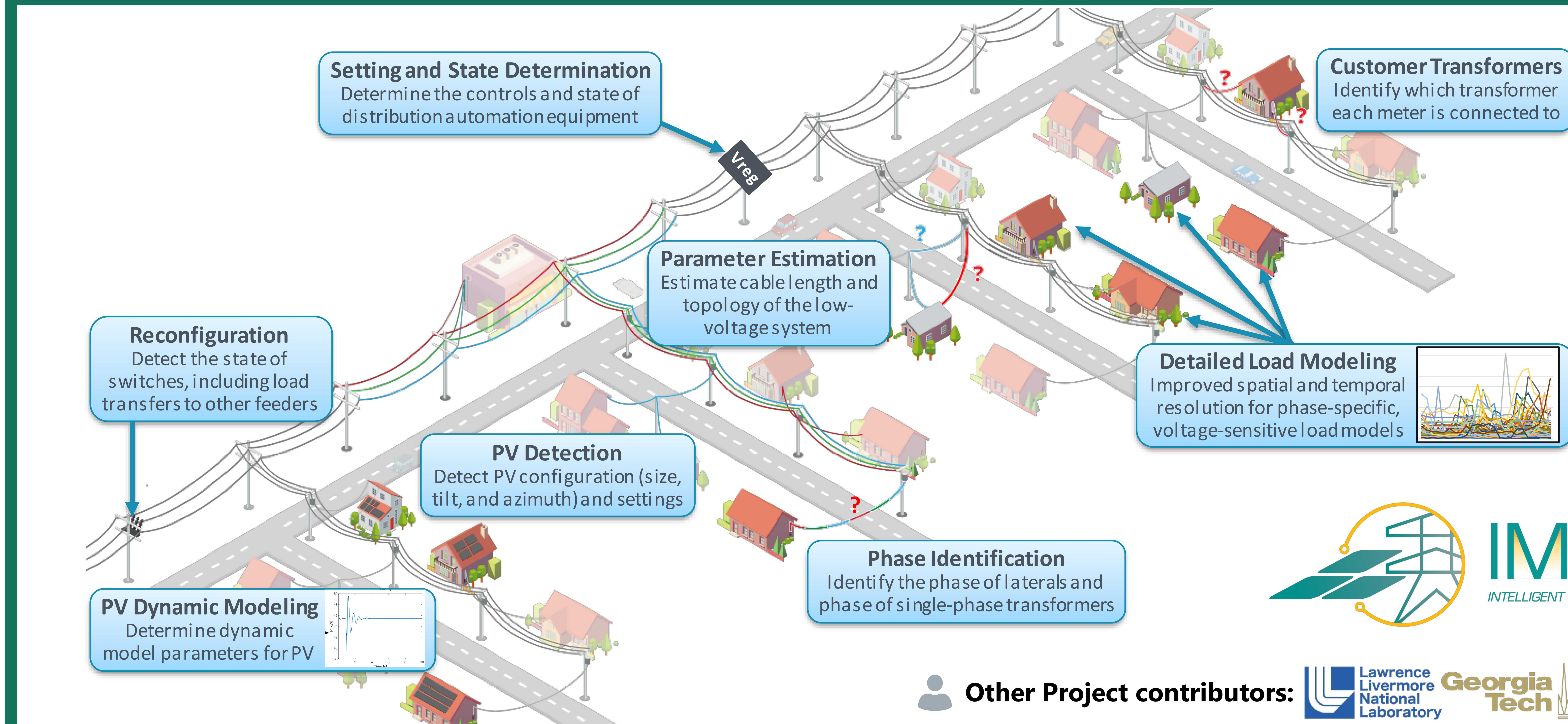

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