Digital Integrated Tools for the Grid

Western Energy Imbalance Market
Regional Issues Forum

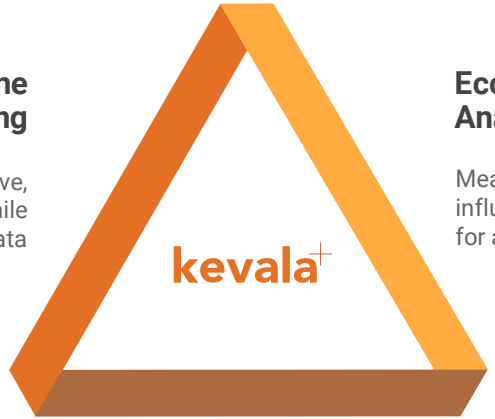
June 21, 2023


kevala
GRID INTELLIGENCE, DELIVERED.

Combining the only truly integrated analytics and machine learning solution for the grid

Machine Learning

Generates massive, high confidence data sets while cleaning & validating customer data



Econometric Analytics

Measures human and market influences on grid operations for accurate time scale analysis

Physics-Aware Grid Modeling

Down to the wire resolution with multi-year forecasting capabilities

Solutions without all three capabilities don't stand up in the real world.

User Applications

Explore Object Context

Historical Analysis

Scenario Modeling

Data Collaboration

Operation Dashboard

Analytics Modules / Use Cases

Integrated Grid Planning

Electrification of Transportation

Project Siting

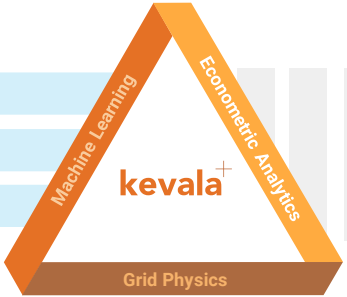
Carbon Intelligence

Cyber and Security

Financial Markets

Pipelines / API

- API
- Data Science
- Data Engineering



Core Modules / Discrete Analytics

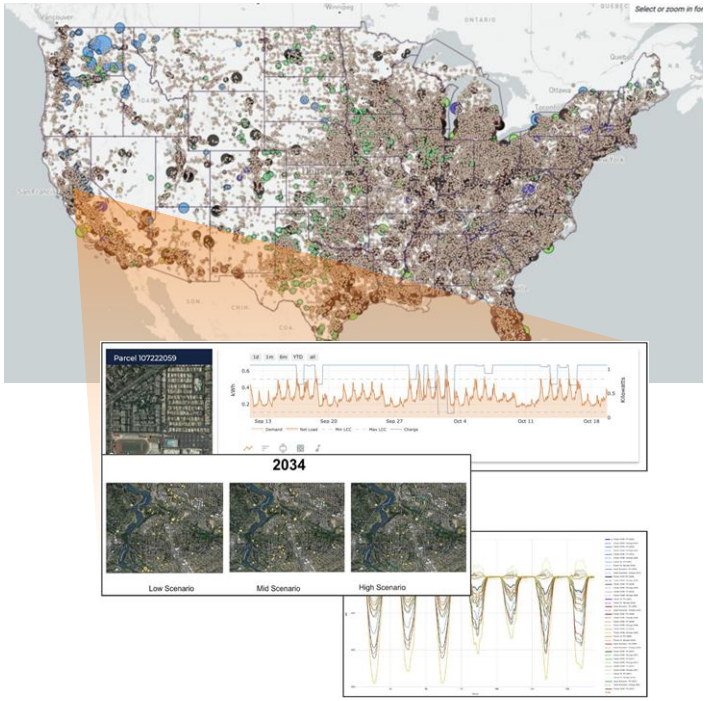
Grid Data	Solar PV	Retail Rate Design
Hosting Capacity	Geography	Distributed Resources
Demand Response	Load	Locational Prices
Transportation	Weather	Carbon Quantification

World's largest energy data repository

Kevala has unmatched visibility and insight

Utility Data

Kevala



A single resource for ANY question about grid decarbonization.

State Electrification Impacts Study: Part 1 Summary

The Context

- In support of a state regulatory agency, Kevala developed a hyper-granular forecast through 2035 that provides insights into ***where*** **and** ***when*** **the distribution grid will need enhancements and the potential costs** of meeting these needs exclusively with distribution assets.

The Approach

- Individually **model baseline load growth, distributed energy resource (DER) adoption and DER behavior for 12 million calibrated to the state's current load forecast.**
- Analyze four alternate scenarios calibrated to different zero-emissions vehicle (ZEV) forecasts and two net-energy metering (NEM) tariffs.

The Results

- Using current processes and without any mitigations, **Kevala estimates tens of billions in distribution investments to support electrification through 2035**.
- Utilities **risk missing the** ***where*** **and the** ***when*** of necessary distribution system upgrades without additional and continuous analysis of data and longer distribution planning horizons.

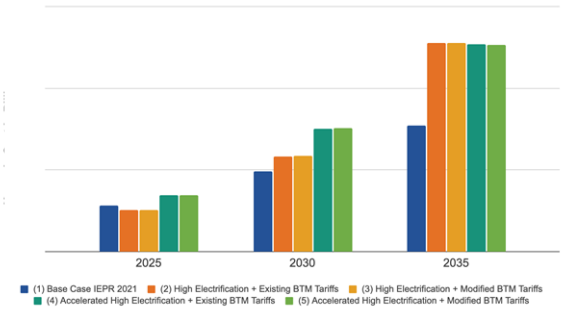
Part 1 **Bottom-Up Load Adoption Model and System-Level Electrification Cost Estimate:** Estimate scale of electrification impacts from the bottom up; enable premise- and circuit-specific grid integration analysis

Part 2 **Staff Proposal:** Support development of Staff Proposal on Distribution Planning Process

Part 3 **Electrification Grid Integration Report:** Framework for estimating localized grid investments and program enhancements; identify NWAs to mitigate electrification impacts

2035 Feeder-Level Capacity Overloading under Accelerated High Electrification

Upgrade costs estimates through 2035



Electrification Impact Study (EIS) - Overview

A new full-scale approach to premise-level analysis that identifies where and when the distribution grid will need enhancements under specific policy or planning scenario assumptions

Forecasted Net Loads

- Estimate net loads at a premise level
- Incorporate adoption of PV, Batteries, Electric Vehicles, and Building Electrification
- Aggregate premise load to locations on the grid
- Generate scenarios of adoption of DERs to test range of outcomes

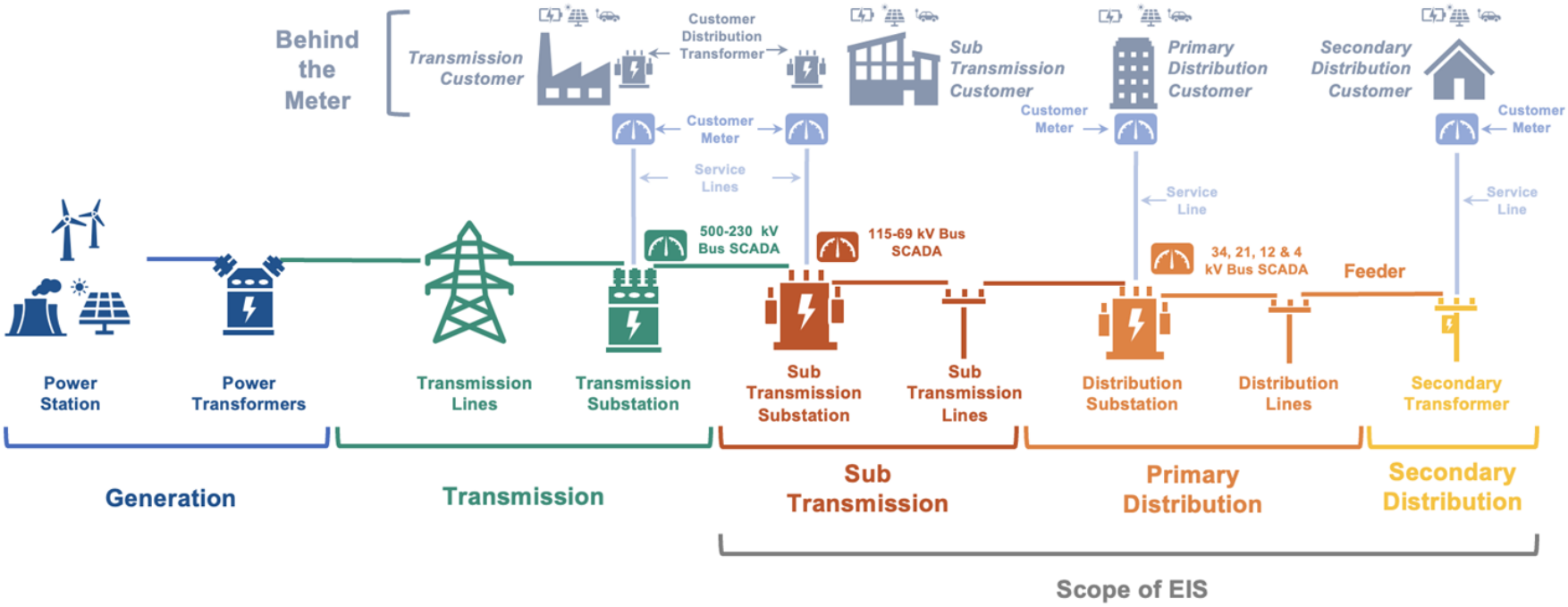
Capacity Needs

- Identify current capacity from secondary transformers to sub-transmission feeder banks
- Determine additional capacity needs due to forecasted net loads
- Determine range of capacity needs based on scenarios of DER adoption

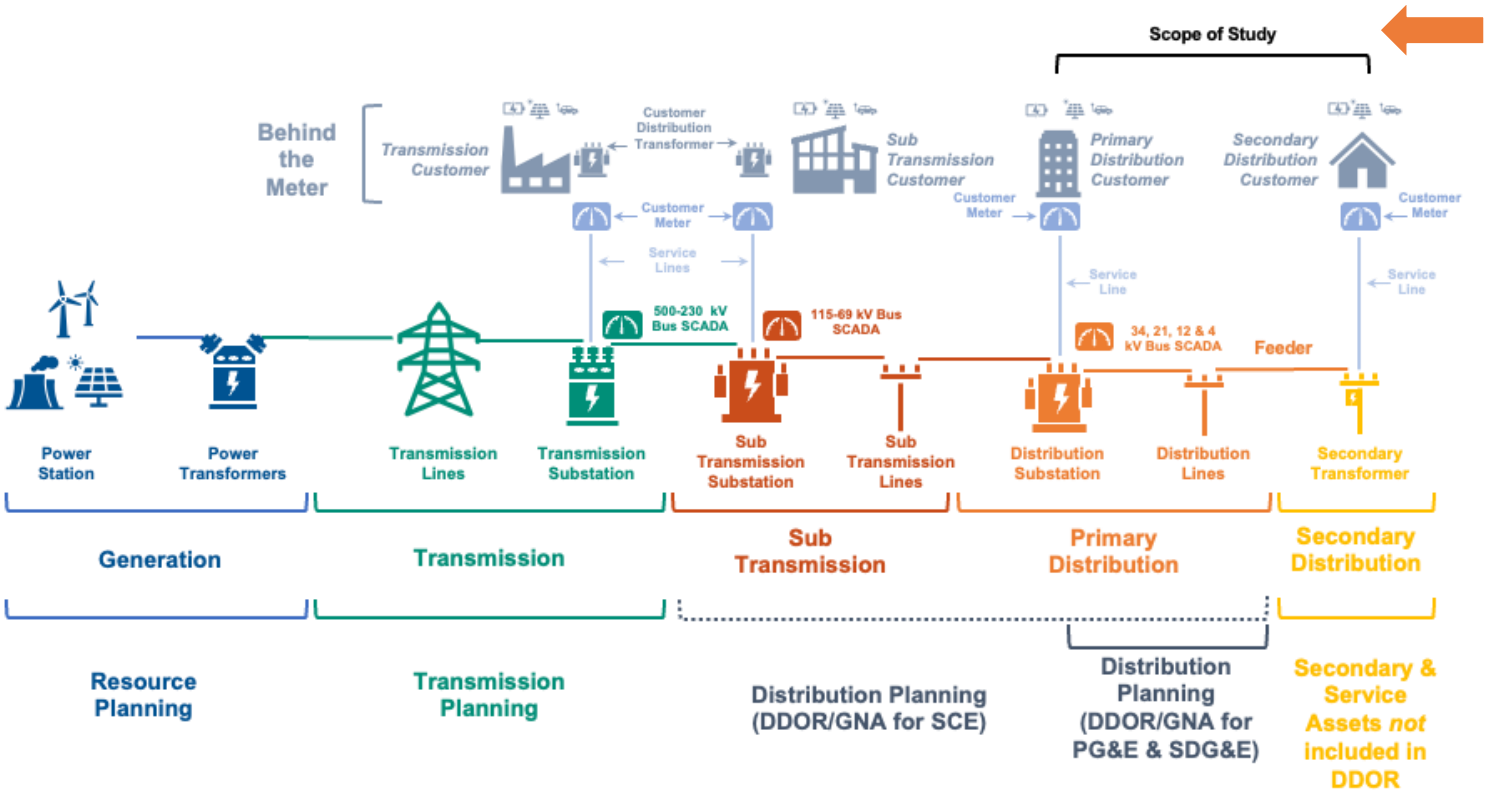
Locational Costs

- Estimate unit costs to meet capacity needs
- Determine incremental capital investments to meet capacity needs
- Quantify revenue requirement and marginal costs by distribution asset
- Aggregate grid asset marginal costs by location

Physical Scope of EIS

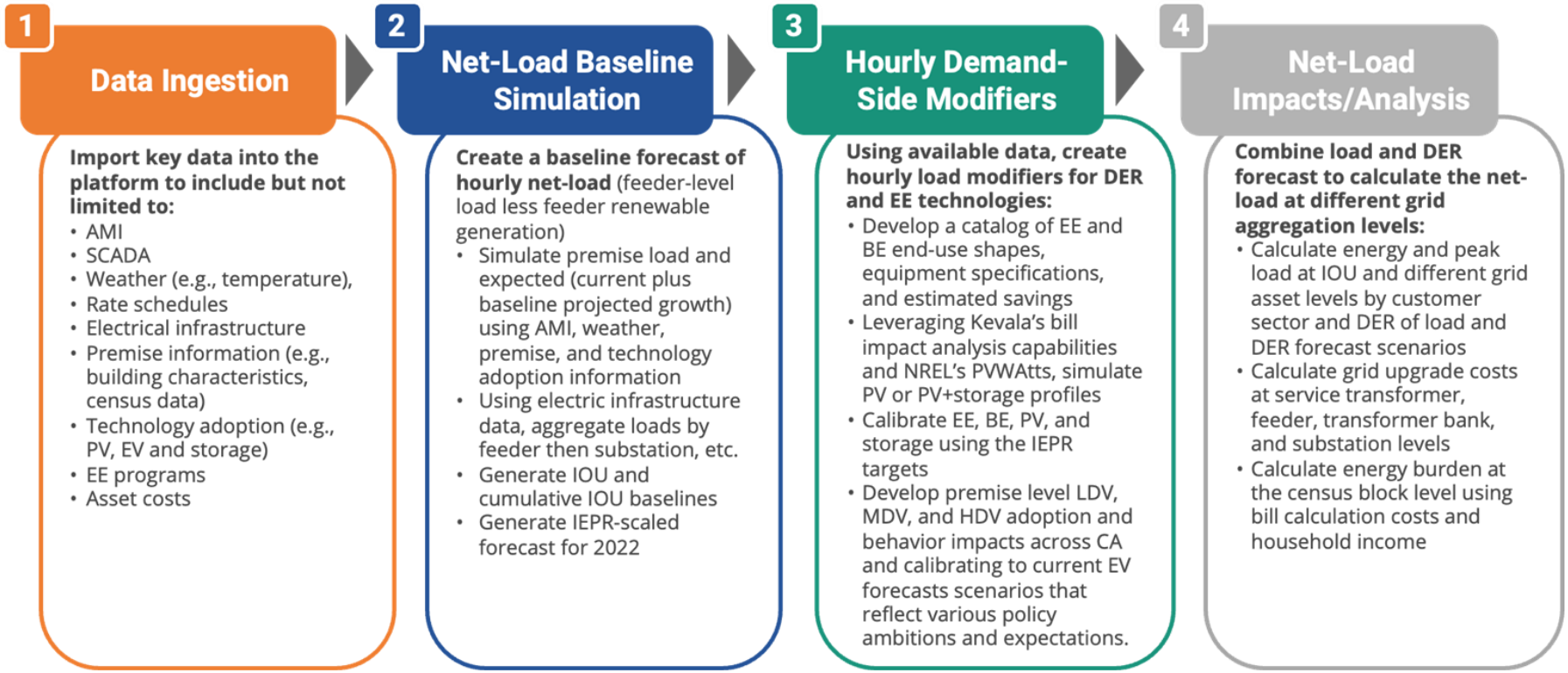


Baseline Net-Load: Objective

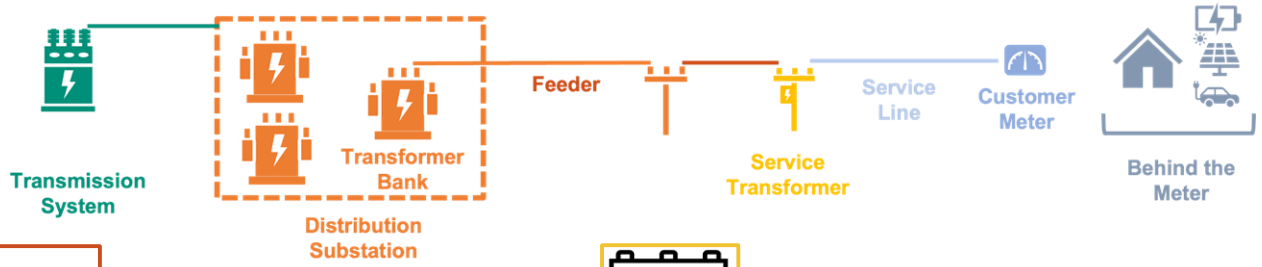


The development of a baseline net-load forecast by premise is that incorporates varied assumptions of demand modifiers to generate is needed to generate estimates of the where and the when of capacity needs at a secondary transformer, feeder, feeder bank, and substation across all three IOU service territories.

Baseline Net-Load: Approach



Infrastructure Upgrade Costs Approach



Step 1- Calculate overload at the substation level

- if spare space in substation, build a new transformer bank
- else, trigger a new substation upgrade

Step 2 - Calculate overload at the feeder level

- if space in transformer bank, build new feeder(s)
- else, if a new transformer bank or substation is built in Step 1, build a new feeder(s)
- else, trigger a new transformer bank or substation upgrade

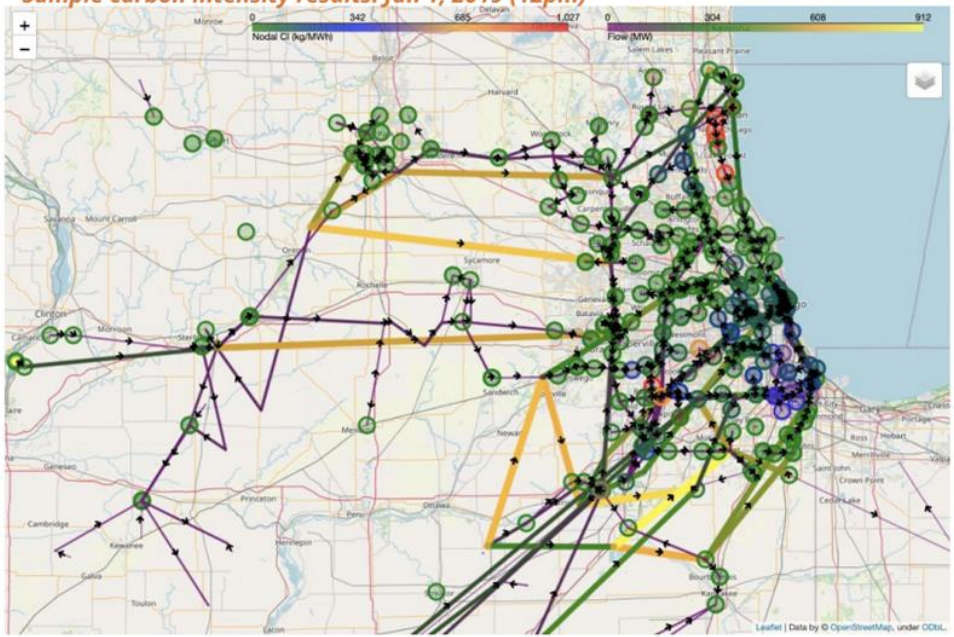
Step 3 - Calculate overload at the service transformer

- If service transformers size < 100 KVA, required number of 50 KVA service transformers
- If service transformers size >100 KVA, a new service transformer that mitigates the overload is chosen

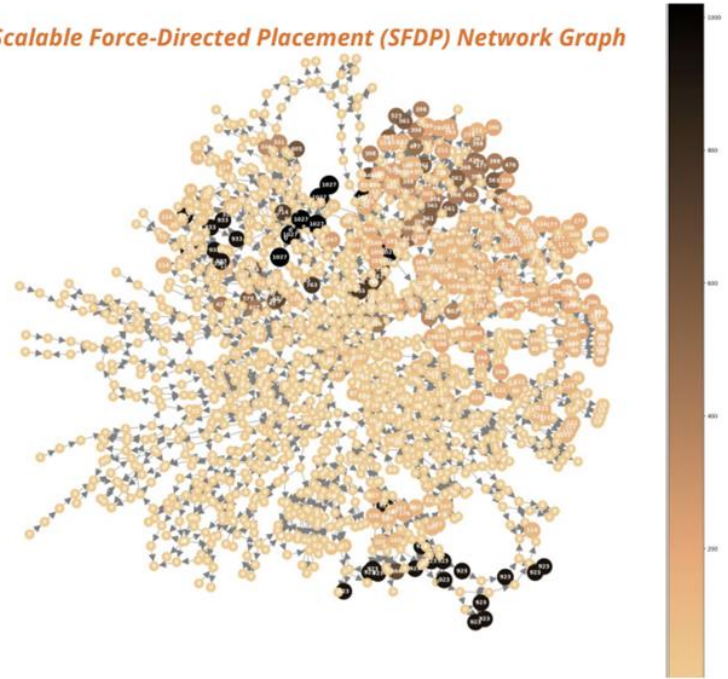
Carbon Tracking Pilot

Across a complicated large territory, there can be times when grid carbon intensity is generally similar. But there are significant differences through time and geography.

Sample carbon intensity results: Jan 1, 2019 (12pm)



Scalable Force-Directed Placement (SFDP) Network Graph



Pilot Results