STARTUP rhythmos HOSTS TVA KUB KNOXVILLE UTILITIES BOARD

EV and Utility Network Management Platform Demonstration

TECHNOLOGY SOLUTION

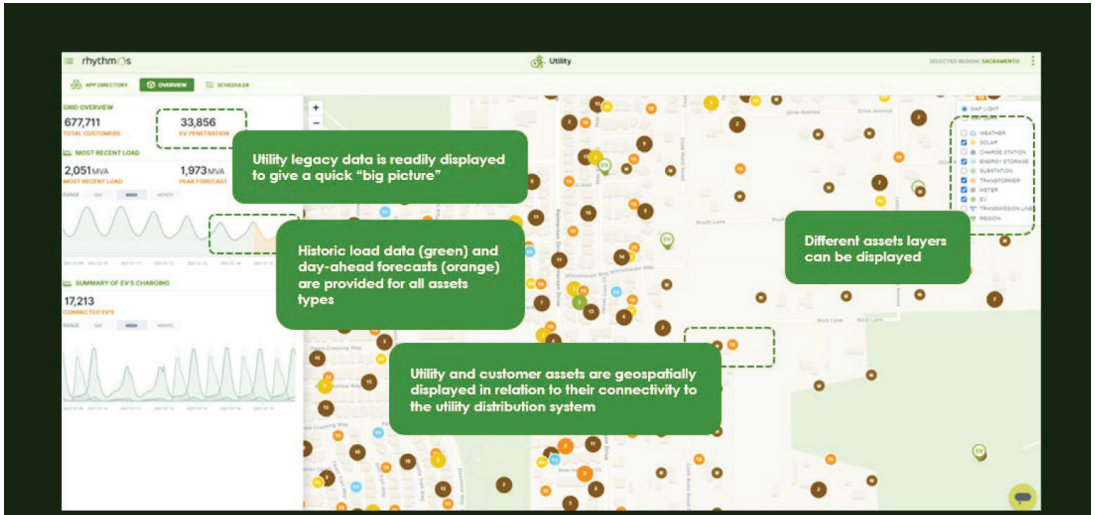
The Rhythmos platform analyzes AMI meter data to identify and signal the presence of electric vehicles (EVs) charging within a utility's network. The goal is to facilitate utility customer program outreach and reduce customer acquisition costs for recruiting EV drivers into managed charging programs. Through the platform's capabilities, EV loads are disaggregated from overall building loads, enabling the characterization of historical charging behavior and the generation of day-ahead charging forecasts for individual EVs.

The platform offers crucial insights derived from the analysis of AMI data, shedding light on existing EV driver behaviors, including when, where, and at what load these vehicles are typically charging. Furthermore, historical loading data on service transformers, feeders, and substations is presented. The Rhythmos platform leverages historical data to produce day-ahead forecasts at the meter level, as well as for service transformers and substations.

In addition to analysis and forecasting, the Rhythmos platform creates a system-wide optimized EV charging schedule that aligns with the operational requirements of each participating EV driver, whether they are commercial or residential. This optimized schedule is communicated to the vehicles through telematics or smart EVSE (Electric Vehicle Supply Equipment) for seamless execution.

PROJECT OVERVIEW

In this project proposal, Rhythmos suggests utilizing historical and weekly AMI data to identify electric vehicle (EV) charging activities within KUB's distribution system. The plan includes the



Rhythmos integrates utility AMI, GIS, SCADA, and OMS legacy systems to provide deeper insights into utility and customer-sited asset loading and generates a granular day-ahead forecast at each asset level.

disaggregation of EV charging loads from overall building loads and the characterization of customer charging behaviors. Rhythmos aims to create a day-ahead prediction for EV charging loads and forecasts for meters, service transformers, feeders, and substations.

Furthermore, the proposal outlines the development of a utility dashboard by Rhythmos to visually represent EV charging loads on meters, service transformers, feeders, and distribution transformers in a geospatial manner. The objective is to provide KUB with a comprehensive overview of the spatial distribution of EV charging activities within its system.

The proposal concludes with Rhythmos planning to conduct an analysis of the implications of EV charging under unmanaged, Time-of-Use, and Rhythmos managed

charging scenarios. This analysis will leverage rate and wholesale energy information provided by KUB and TVA to assess differences in energy cost to serve, potential avoidance of transformer upgrades, and cost savings for EV drivers, among other factors.

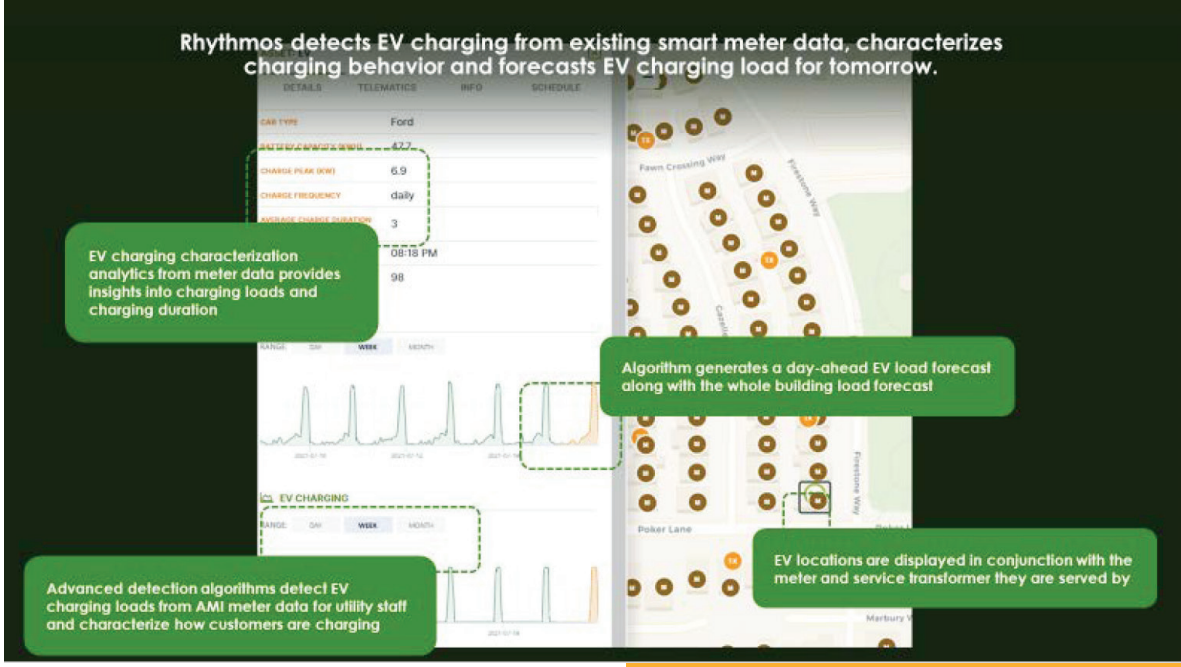
RESULTS & LEARNING

For this project, Rhythmos ingested 3.5 years of historical AMI interval meter data along with asset information from KUB's GIS system, including asset nameplate capacity and the connectivity model between meters, service transformers, feeders and distribution substations. The platform ingests AMI data on a weekly basis to conduct analysis for detecting EV Level 2 charging by meter. Additionally, the Rhythmos platform will be analyzing the interval meter data to disaggregate the EV charging load from the whole building load, and to characterize the charging behavior of EV customers.

Rhythmos will also generating a day-ahead forecast from historical data for service transformers as well as providing historical loading information on each service transformer. Rhythmos is creating a utility dashboard that shows connectivity of EV customer meters to service transformers to feeders to distribution substations using their GIS information. Additionally, the platform will show historical distribution system asset loading geospatially via the weekly provided AMI and GIS data.

Key outcomes and learnings for the project include:

- The foundational effort to link meters to service transformers and other critical grid equipment has unlocked a host of opportunities, including data visualization, data cleansing, and advanced analytics.
- Of the approximately 210k meters analyzed, the EV Identification algorithm is identifying meters that exhibit repeated L2 charging behavior. This information can be fed directly back to the project team to aid with both M&V and help KUB monitor ongoing EV adoption for both planning and operations.
- EV Disaggregation will be applied to all 500 known EVs recognized by KUB, as well as newly identified meters that have been detected.



By deploying Rhythmos' software, we gain powerful insight into our customers' needs so that we are better prepared to manage EV charging loads. This deployment signifies a step towards a more intelligent and responsive energy grid.

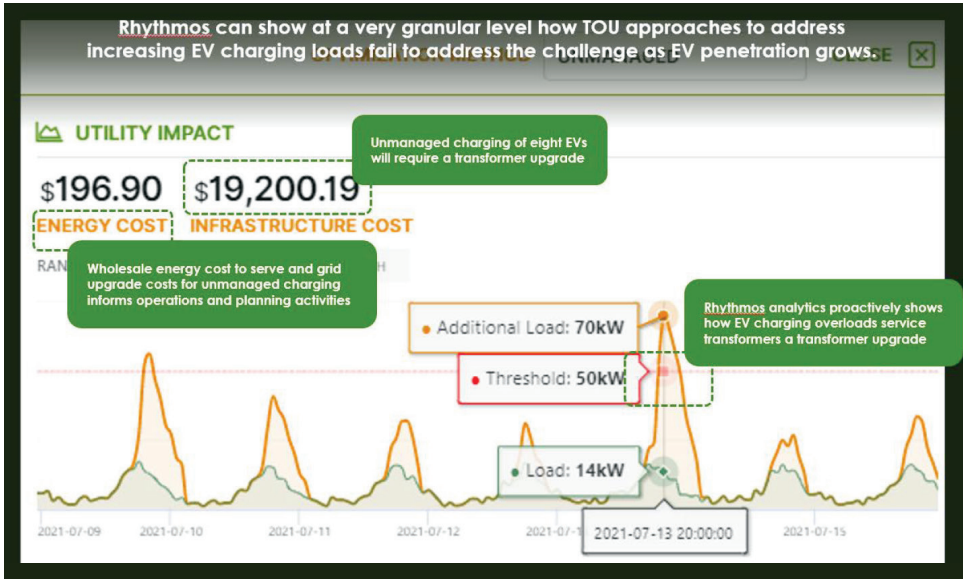
Mathew Stinnett
Manager of Electric Engineering
Knoxville Utilities Board

IMPLICATIONS & NEXT STEPS

EPRI is leading an M&V phase and has approved the underlying reports being generated by the Rhythmos platform to support this effort. The underlying EV sub-meters have been procured with the meters expected to be operational by Q4 2023. Once the meters are installed and suitable data has been collected over a representative sample period, EPRI will be able to proceed with the M&V phase.

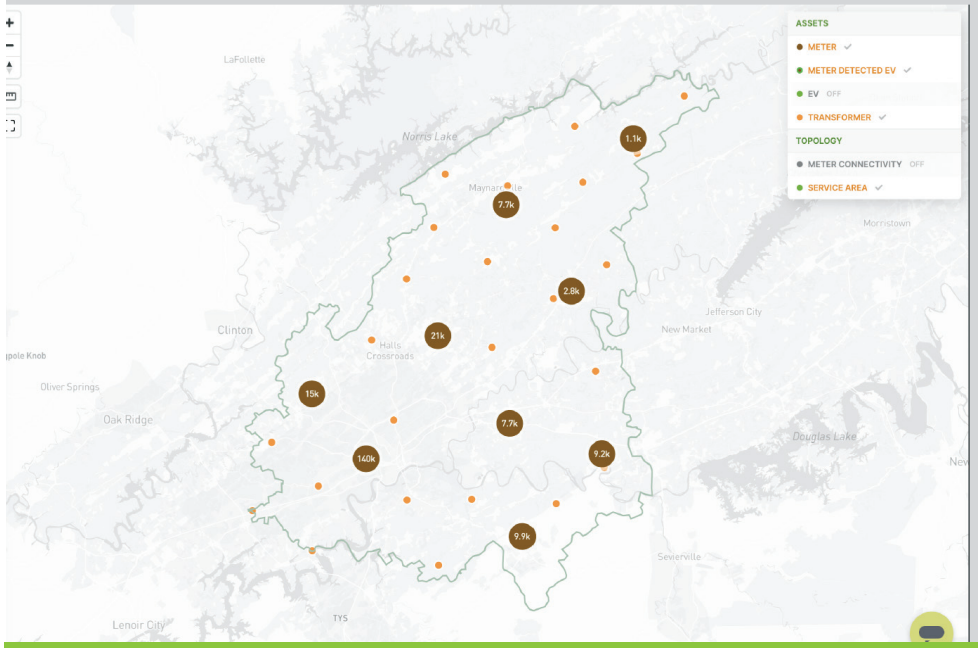
From the Rhythmos perspective, the following are the next steps which include continued execution of the pilot scope of work and utility feedback on:

- Deeper analysis of detected EV's to quantify the impacts of EV penetration on associated service transformers and upstream assets
- EV Disaggregation reports for known and newly identified EVs that have been detected
- Day-ahead forecasts for service transformers and predictions for EV charging loads.
- A tariff study to measure the impacts of optimized managed charging



Today's utilities are doing everything they can to support electric mobility and to meet charging demand in time to scale up in tune with the EV industry. This is why we are sponsoring this smart charging deployment between KUB and Rhythmos.

James Linder, Innovation Program Manager, Tennessee Valley Authority



TVA is proactively working with our Local Power Company (LPC) partners, like KUB, to prepare for and enable EV adoption across our service area. EVs have tremendous flexibility when they charge; managed charging strategies shift EV charging to off-peak hours which increases system utilization and reduces the need for costly utility system upgrades as EVs grow in popularity.

Ryan Stanton, Senior Project Manager, EV Evolution, Tennessee Valley Authority

RESOURCES

MARK RAWSON
SVP, Partnerships and Strategy
mark@rhythmos.io

RYAN STANTON
Senior Project Manager,
EV Evolution
Tennessee Valley Authority (TVA)
rkstanton@tva.gov

MATHEW STINNETT
Manager of Electrical Engineering
Knoxville Utilities Board (KUB)
Mathew.Stinnett@kub.org

KRISH GOMATOM
Technical Leader III
pgomatom@epri.com

INCUBATENERGY LABS

RESOURCES

DAN KILLOREN, PH.D.
Program Manager
Global Innovation Hub
dankilloren@epri.com

JERRY LIGRANI
Program Lead
Incubatenergy® Labs
jligrani@epri.com

labs.incubatenergy.org

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3002028660 March 2024

EPRI
3420 Hillview Avenue, Palo Alto, California 94304-1338 USA
800.313.3774 • 650.855.2121 • www.epri.com