EVS36 Symposium
Sacramento CA, USA, June 11-14, 2023

Utility Project Case Studies in Fleet Electrification

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Executive Summary
Utilities and their fleets around the globe are engaged in new relationships with one another as they plan for growing energy demands needed to support fleet electrification. The rapid growth in electric vehicles (EV) creates uncertainty in how the charging load will impact utility grid infrastructure, making long-term planning even more complex. To plan, one needs to know when, where, and how much vehicles are going to charge, both now with few EVs and in the future as uptake increases. Understanding this is difficult because energy demands for each vehicle vary greatly. The aggregate EV load is impacted by the number of EVs, daily driving habits, the time of day the vehicles will charge, and the seasonal variance in temperatures and driving operations. The variability makes planning difficult.
Keywords: alternative fuel, energy consumption, electric vehicle (EV), electric vehicle supply equipment (EVSE), utility.

1 Introduction
Utilities are working to understand how the growing number of electrifying fleets will impact their grid. Identifying where and how much charging infrastructure is needed for a fleet requires a different methodology than planning for public charging.

2 Project Approach
Fleet electrification is complex, and non-linear. Traditional feasibility and planning assessments rely on averages, assumptions, and subjective data, which often does not result in realistic recommendations for fleet electrification. Fleet electric vehicle suitability, charging infrastructure planning and EV optimization require participation from many parties and a fine-grained observation and analysis of each vehicle mile travelled.

2.1 Stakeholder Engagement
When an organization is preparing to use electricity as a fuel it requires early engagement with their utility as well as cross-functional internal engagement. The analytics partner is a subject matter expert that can facilitate introductions to all stakeholders; bringing them together to successfully achieve their common goal.

2.1.1 Utility
The utility will identify the fleet client in need of services through relationships with area managers, outreach, and other methods. Several roles within the utility will be engaged throughout the project period

and poised to guide the client to next steps post-project, providing a seamless experience for the customer.

For example, in the program offered by Xcel Energy (XE), the fleet program manager is involved in the entire fleet electrification process, from bringing the customer into the assessment program, through design and construction of charging infrastructure. By understanding which EV replacements and associated charging infrastructure is recommended through the assessment program, Xcel Energy can plan for infrastructure upgrades. The Xcel Energy fleet program manager also assists the fleet customer with securing funding through XE provided rebates, construction allowances, and charging optimization programs.

2.1.2 Client

Utility customers' public and private fleets are being encouraged and/or mandated to add electric vehicles to their fleets through policy and leadership. Additionally, many organizations are seeking carbon reduction, and decreasing transportation emissions can be an impactful strategy. The utility client organization will likely engage fleet, facilities, and sustainability staff to oversee the project and receive results of the study. Fleet managers will benefit from vehicle specific replacement recommendations, operating and capital budget impact projections, and real-time observation of EV already deployed in operations. Sustainability staff are interested in reduction projections and accounting for carbon and air quality impacts resulting from vehicle electrification. Energy demand projections provided on a per site basis assist facilities staff in near and long-term planning for electric vehicle supply equipment.

2.1.3 Analytics Partner

The analytics partner should guide the data collection process, interpret results, provoke meaningful conversations, and provide actionable guidance. An exceptional partner will not only provide objective recommendations based on actual vehicle use but also industry experience to address client concerns.

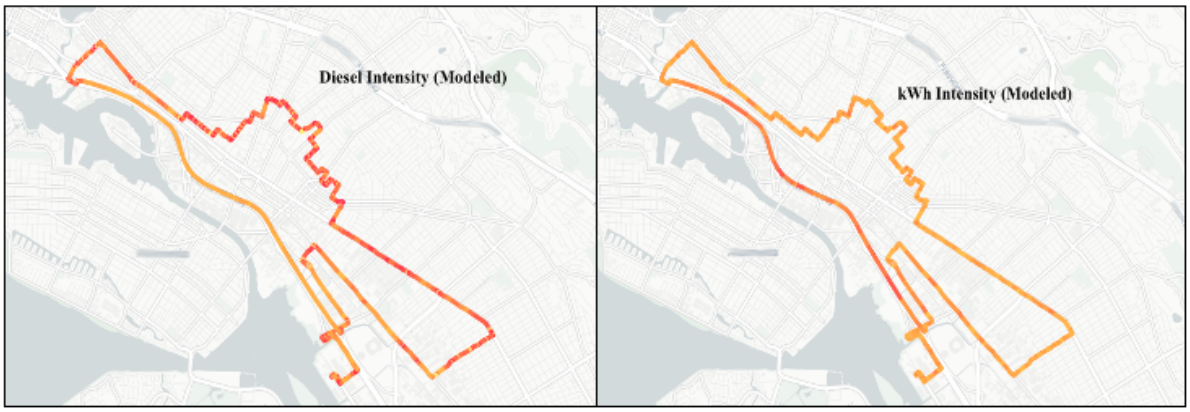
2.2 Methodology

The Sawatch Labs analytics tools require telemetry, are provider-agnostic, dynamic and scalable. By selecting a granular, objective data set for the basis of the analysis we are allowing the vehicle to be the source of truth. Through the telematics data source, we analyze vehicle activity every minute of every day for a minimum of 90 days and up to one year or more. We aim to reduce estimations, averages and assumptions that can result in oversized charging infrastructure, avoid placing EV in poor performing applications, and optimize the use of EV to achieve maximum environmental and economic benefit. By ingesting data and mapping to a robust software solution, software can handle immense volumes of data with speed and allow an analyst to focus on delivering actionable results. For example, 20,000+ vehicles with 365 days of data each can be processed within a matter of hours.

2.2.1 Energy Modelling

Core to the Sawatch Labs' approach is our ability to model daily energy demands based on actual observed use. Telemetry allows one to understand speeds, road types, idle times, altitude dwell locations and more. A sophisticated vehicle classification system aligns ICE vehicles, even with specialty duties like refuse haulers, to like EV. This data becomes even more powerful when combined with external data sets such as local ambient temperatures.

Figure 1. Diesel versus kWh Intensity Model



2.2.2 Robust Analytics Software

Sawatch Labs' Electric Vehicle Suitability Assessment (ezEV) provides internal combustion engine (ICE) fleets with specific recommendations for which vehicles are good candidates for replacement with an EV. This is determined based on an economics comparison and, perhaps more importantly, by analyzing the operational impacts of daily driving behavior for each vehicle. Our Infrastructure Optimization application (ezIO) is the companion product to ezEV and provides total estimated energy demands per location. The results provide decision makers with a vehicle-specific Total Cost of Operation (TCO) comparison, estimated charging infrastructure needs, and metrics on the environmental benefits.

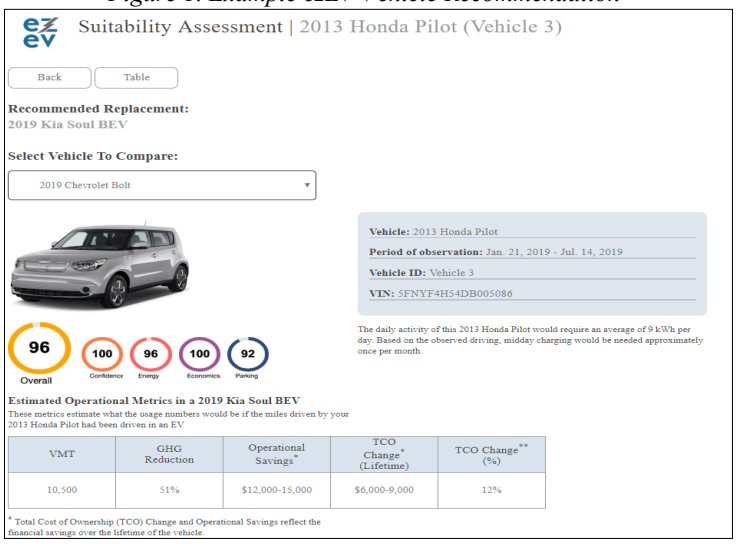
For the EV's that are already in the fleet we provide analytics and consultation designed to observe and maximize EV performance. ionEV is a web-based application that programmatically digests tens of thousands of raw data points - turning them into dynamic, graphical, and tabular insights. Sawatch Labs configures this tool with minimal effort from the client fleet and then provides one-on-one consultation throughout the EV observation period. Our consultations involve application training, review of analytics insights, and reports delivery designed to provide specific direction to increase EV performance and optimize economic and environmental savings. Of course, the fleet also has access to the online application at any time and it is designed to be self-serve.

3 Results

3.1 Vehicle Specific EV Recommendations

Each vehicle analyzed will be given a pass or fail score on a scale of 1-100 with sub scores designed to reveal the reasons that vehicles are a fit or not. Details will be provided for daily energy use, estimated charging time and cost, economic and environmental savings.

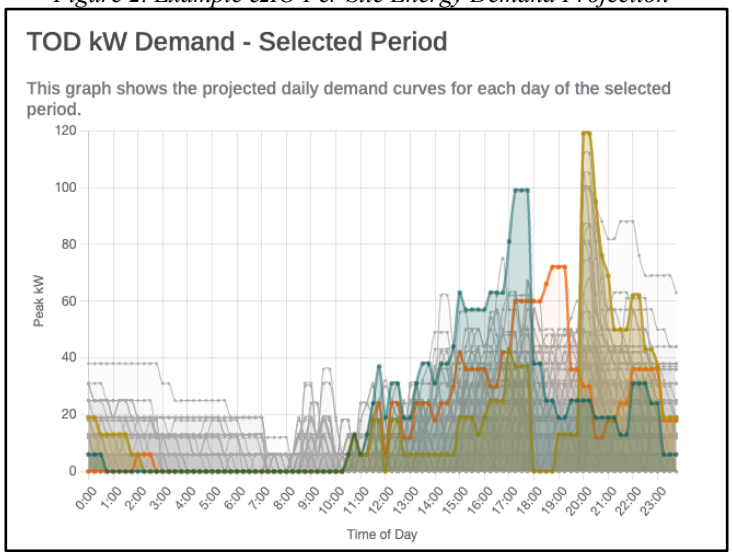
Figure 1. Example ezEV Vehicle Recommendation[1]



3.2 EVSE Infrastructure Projections

Specific dwell times and locations are identified through telemetry, allowing insights into projected charging behavior on a 15-minute demand interval for each vehicle and then aggregated to potential charging site locations. All stakeholders will understand all locations where and when charging infrastructure would be suitable based on actual observed vehicle operations. For Xcel Energy, fleet customers who have gone through the assessment program have the benefit of already understanding where charging infrastructure is needed and what level of charging will be suitable for their fleet. “This takes the guessing out of investing in expensive charging infrastructure,” says Skyler Potocek, Xcel Energy, Customer Program Administrator, Clean Transportation. Fleets can benefit from reduced costs by confidently rightsizing their infrastructure. Additionally, utilities can benefit from the use of telemetry to project charging behavior, as utilities begin to plan for grid upgrades to accommodate high kW charging.

Figure 2. Example ezIO Per Site Energy Demand Projection[1]



3.3 EV Performance and Verification

For fleets that have EV already in operation telemetry will be gathered to observe and report on utilizations. Reports will include metrics on electric miles travelled, gas miles travelled (for PHEV), estimated fuel and emissions savings, charging session details and opportunity costs for missed charging events.

3.4 Make-ready Infrastructure Programs

At the conclusions of our participation in each pilot the utility will use the results of the charging demand analysis to offer infrastructure installation assistance to each fleet. This may include onsite upgrades, funding or both.

Xcel Energy provides no- to low-cost turn-key construction services for infrastructure through their Electric Vehicle Supply Infrastructure program. This program includes working with customers on both design and build-out. As a part of this program, an Xcel Energy advisor is paired with each customer to guide them through the process of accessing their charging needs and planning execution. The Xcel Energy make-ready infrastructure service takes the guess work out of finding electrical capacity for chargers. Program participants receive Xcel Energy-owned EV supply infrastructure installation and maintenance at no cost. Customers can then choose to procure their own EV charger equipment from a prequalified list or rent equipment from Xcel for a monthly fee. Additionally, customers can charge for less with Xcel's low-cost, off-peak pricing.

4 Case Studies

Through multiple utility advisory programs, with different utility partners, we can offer a few samples of work and results for fleets at varying stages of electrification.

4.1.1 Small university fleet in early stages of electrification

Many small, public and private fleets are just beginning their fleet electrification journey. They may be electrifying in response to leadership policy or at the direction of leadership. Fleet managers are looking to place EV in successful applications and avoid failure and need to coordinate with facilities and sustainability roles. University fleets, like many fleets, rely on available infrastructure funding from utilities to install EVSE. In this study, we observed vehicle activity for a utility located in north central united states. The utility sponsored a study for a local university. The vehicles included in the study were a mix of minivans, sedans, UTVs, SUVs and pickup trucks. Generally, the fleet operates in a small geographic area but even so we identified 12 potential EVSE sites locations within the campus. Two additional locations were identified offsite at research stations. This analysis provided EVSE siting guidance, using specific dwell locations with recommendations for location consolidation to reduce installation and/or make-ready costs and to maximize port to vehicle ratios. The vehicles are high utilization but lower mileage; a use pattern particularly well suited to our data analysis methodology. Low mileage vehicles often do not offset the operational savings needed to justify a higher procurement cost for an EV. Through telematics data collection, we were able to capture idle times and account for associated energy use and make the business case for total cost of ownership savings.

4.1.2 The City of Mankato, MN prepares for electrification.

The city operates about 220 on road vehicles and recently worked through Xcel Energy's Fleet Advisory Program to analyze 100 gas vehicles of their 220, based on vehicles that have "like" EV types available on the market today. "The primary goal of the study is to determine which vehicles could be replaced with EVs," said Rick Baird, Mankato's environmental sustainability coordinator.[3] The results of the study found that roughly half of the 100 vehicles studies could be replaced with electric vehicles and results in economic savings with minimal impact to daily operations. The city plans to purchase four EV as a start and observe and support their success within the fleet operations.

"Among the specific vehicles studied by the Xcel team, a city-owned 2018 Ford F-150 was tracked from June 2021 through January 2022, during which it made 740 trips totaling more than 2,700 miles. If that vehicle was replaced with an all-electric Ford Lightning F-150, the reduction in greenhouse gas emissions would be 86% during its lifetime of service. In addition, the lifetime operational costs of the EV pickup were projected to be $21,000 to $24,000 less. Even if the higher purchase price of the electric F-150 was included, the EV was projected to cost the city $9,000 to $12,000 less to buy and operate than a comparable gas-powered F-150."[2]

Acknowledgments

Xcel Energy, their Fleet Electrification Advisory Program and their staff who oversee the program.

The City of Mankato, MN.

All employees at Sawatch Labs who work hard to deliver actionable results to all fleets with whom we engage.

References

[1] The images were produced using Sawatch Labs, ezEV and ezIO Software.

[2] Mark Fischenich, April 8th, 2023, "Mankato To Begin Converting Vehicle Fleet From Gas To Electric", Mankato Free Press, https://www.mankatofreepress.com/news/local_news/mankato-to-begin-converting-vehicle-fleet-from-gas-to-electric/article_6ea378da-ce64-11ed-bb8e-87c83faae2b8.html#:~:text=The%20city%20of%20Mankato%20is%20planning%20to%20buy%20a%20fully,the%20municipal%20fleet%20to%20EVs

Presenter Biography

Mary has leveraged the power of driving data for more than ten years to change driver behavior, increase safety, and reduce fuel consumption and emissions. With her extensive knowledge of embedded telematics systems, she led deployments in over 20 countries. She enjoys using her expertise to drive smart, economical fleet electrification and optimization. Mary is proud to serve as board secretary for the Drive Clean Colorado, a Clean Cities Coalition.