DR^x for Grid Mod / System Planning: **Electric Vehicle (EV) Penetration**

COMMON CHALLENGES

- Utilities are under pressure to develop integrated Distribution plans that enable constraint-free distribution networks with the ability to host an almost unlimited amount of DERs. This includes solar, and storage, wind, electric vehicles, etc.
- EVs in particular worry some utility executives because they know so little about where on their system these sources of significant incremental load are likely to appear, and when.

ABOUT DR^x – *"DISTRIBUTION RELIABILITY EXCELLENCE"*

Our solution helps executives, managers, and reliability engineers to manage key metrics and essential data. **The EV Analysis Module** leverages utility and external data along with AI and proprietary modeling techniques to help you plan where and when EV load will be added to your system. This allows for proactive, integrated system planning and robust assessments for regulators and other key stakeholders.

WHY UMS GROUP

We pride ourselves on being a strategic partner - external experts / consultants with broad industry experience in helping utilities adapt and drive sustainable change and performance gains across their business. Besides 30+ years bringing best practices and pragmatic insights to the utility industry, data scientists in our analytics & tool dev center use machine learning / AI to embed that operating expertise into advanced decision support tools that eliminate 70-80% of analyst work required to get answers.

KEY DEPARTMENTS TO BENEFIT

Distribution Planning

Identify the (non-linear) rate at which load is going to increase and where on the system, and plan accordingly for upgrading subs and building/u[grading feeders, as well as intermediate load transfers.

Regulatory

Produce detailed, credible analysis and visualizations for the regulator to educate commission staff and ensure requested funds will be sufficient to meet demand in the coming years, based on best available information and models.

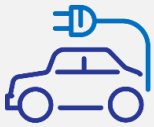
Renewables

Powerful insights into circuit and substation hosting capacity to support integrated distribution planning, with more accurate locational analysis of EV additions and other DER penetration over the next 10 years.

INSIGHTS YOU NEVER THOUGHT POSSIBLE

Predict Customer EV Early Adoption Behavior

Utilize psychographic data to predict which customers are most likely to buy EVs, and when, combining your own and other available data sources through DR^x.



Target Growth Locations

Rather than considering growth from EVs at a system-wide rate, forecast it at the individual circuit, segment and substation level.

Time the Growth

Research shows that EV penetration will not be linear over the next years or even within each year. Forecast load increases at yearly and even monthly levels based on demonstrated consumer behavior.

Visualize Geographic Landscape

Map charging stations, EV dealerships, and even bus garage locations to integrate commercial/transit system impacts.

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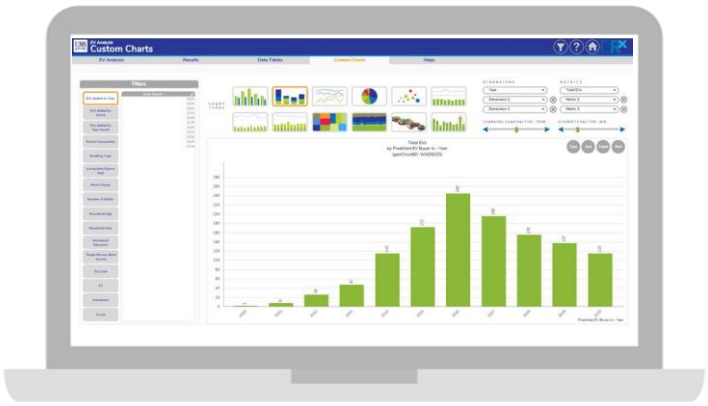
Don't fall into the trap of planning for linear EV growth across your network and over time

- Customers across your service territory are not equally likely to buy EVs. Early adopters will tend to be clustered, with disproportionate impact on selected circuits, accelerating system investment needs.
- In a recent study for a large east coast utility, we determined that **90+% of early adopter EVs will be purchased and installed on less than 1/6 (~15%) of distribution circuits**. This clustering will accelerate the schedule for EV system impact and associated infrastructure reinforcement requirements by a factor of 6 to 10 compared to analysis based on system-wide average EV numbers and load impacts.
- Therefore, system reinforcement at the distribution feeder and sub segment level are likely to be **required as much as 10 years before average system impacts might suggest**.
- Our analysis shows this east coast utility will have EV related **system reinforcement needs that exceed their entire current annual distribution capital budget within 5 years**.

DRˣ uses psychographic data along with utility and external data to model which customers are most likely to buy electric vehicles and when. This provides planners with a much more realistic view of where system modifications will be needed and their associated timing.

Total EV Charging Peak Load by Circuit by Year

Total Added EV Load by Year and Cumulative



Total EVs Added per Year – Individual Circuit

- Plan at the feeder level with EV count & load added by month to existing peak MVA of each feeder, plus impacts of expected economic growth and projected energy efficiency gains, to project when that feeder can be expected to exceed load thresholds.
- Our model has an R^2 value ("goodness-of-fit" of the data to the regression line) of almost 70% compared to 13% for public data and 30% for industry "experts".

> ***"DRˣ has allowed us to more easily visualize proximity of circuits and substations to new loads from EV charging. It has significantly upgraded the accuracy and credibility of our forecast for when "EV Make Ready" system reinforcements will be needed."***
> *– Director, Distribution Asset Strategy, Large East Coast combination utility*

www.umsgroup.com
DRx@umsgroup.com
+1 (973)335-3555

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