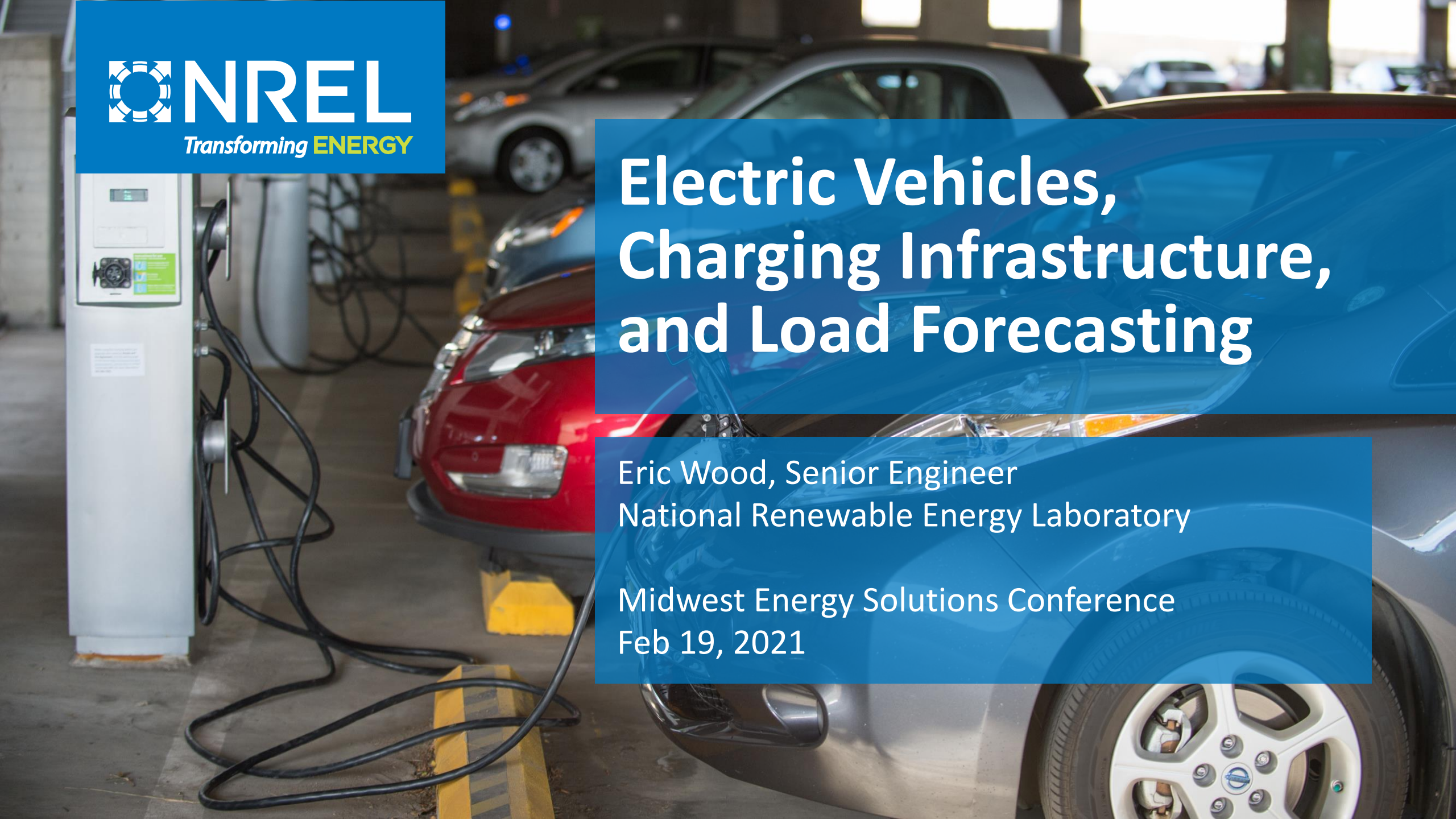


NREL
Transforming ENERGY

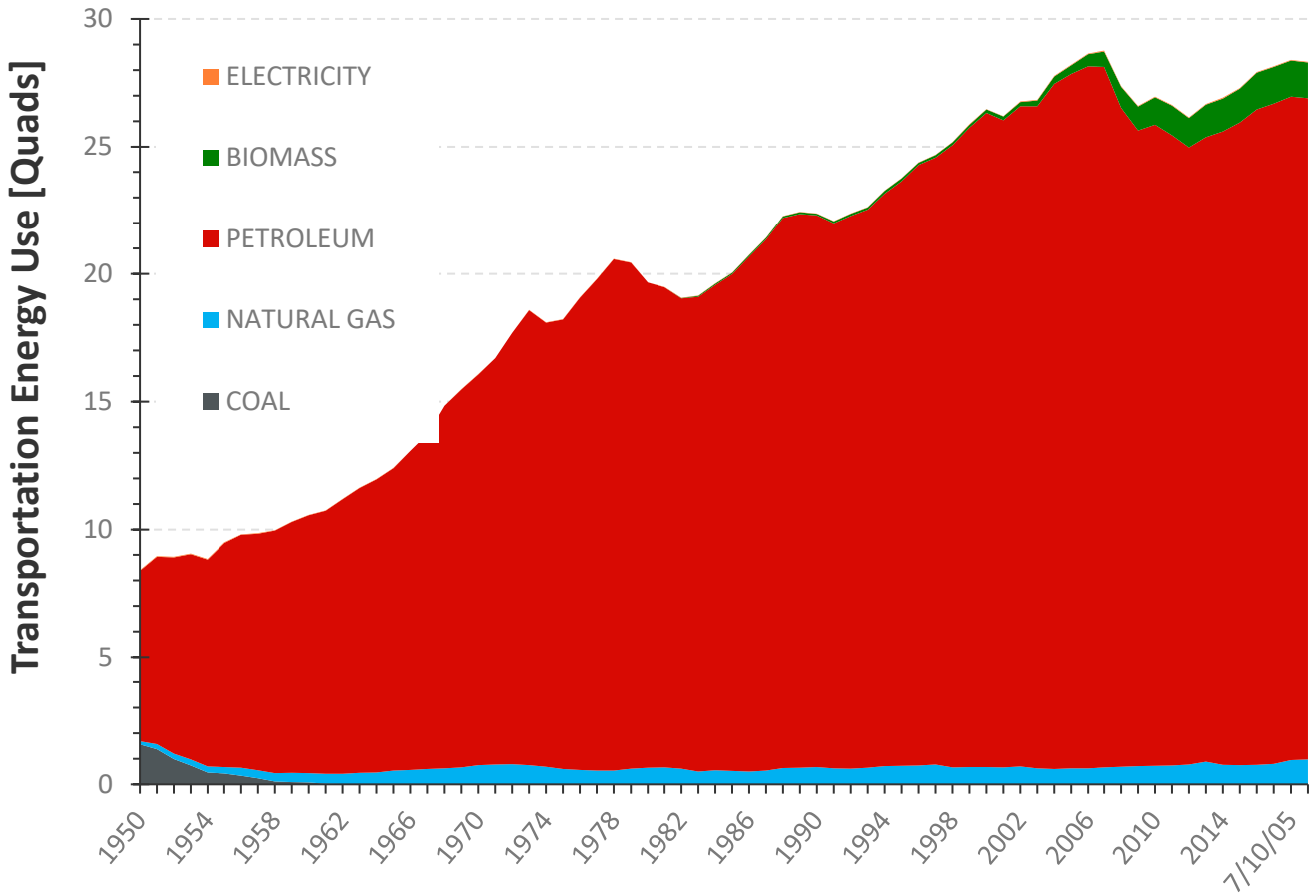
Electric Vehicles, Charging Infrastructure, and Load Forecasting

Eric Wood, Senior Engineer
National Renewable Energy Laboratory

Midwest Energy Solutions Conference
Feb 19, 2021

Historically the US vehicle market has been monolithic

Over 90% of transportation energy use from petroleum



Source: NREL. Data from EIA Annual Energy Review

…but there is growing momentum for EVs

EVs Are the Future, GM's Mary Barra Says. Where the CEO Sees Growth.

By Shalna Mishkin Updated Nov. 12, 2020 7:14 pm ET / Original Nov. 12, 2020 5:09 pm ET

Ford is 'absolutely' interested in producing EV batteries like Tesla and GM

PUBLISHED FRI, NOV 13 2020•12:12 PM EST

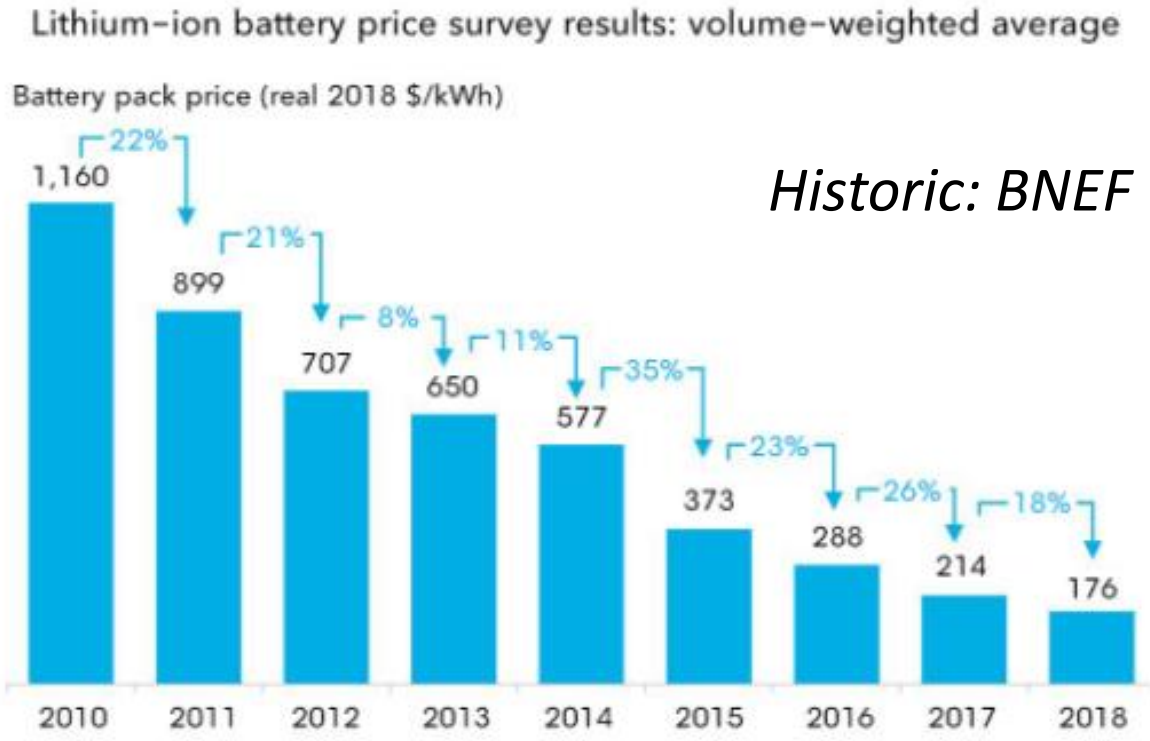
VW CEO says existential electric race awaits after pandemic

Christoph Rauwald, Chad Thomas and Daniel Schaefer Bloomberg

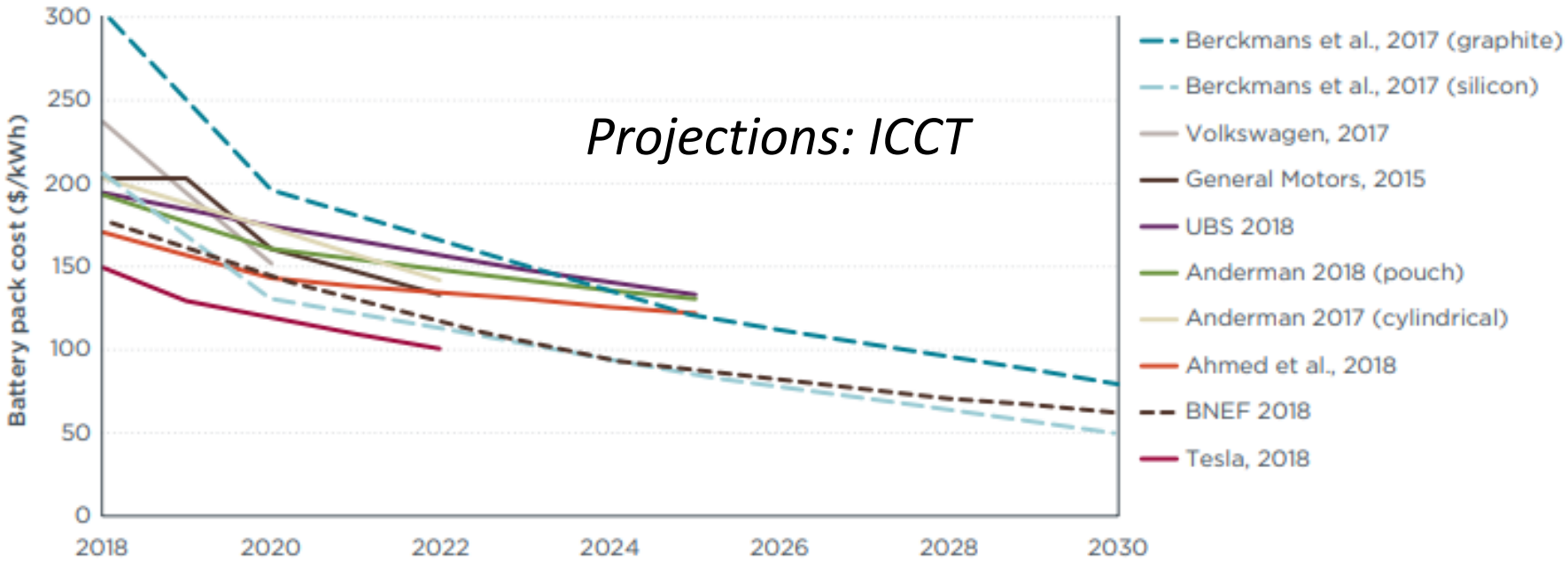
Published 9:21 a.m. ET Nov. 5, 2020

Plummeting battery prices have been an enabler over the last decade…

And costs are projected to continue falling



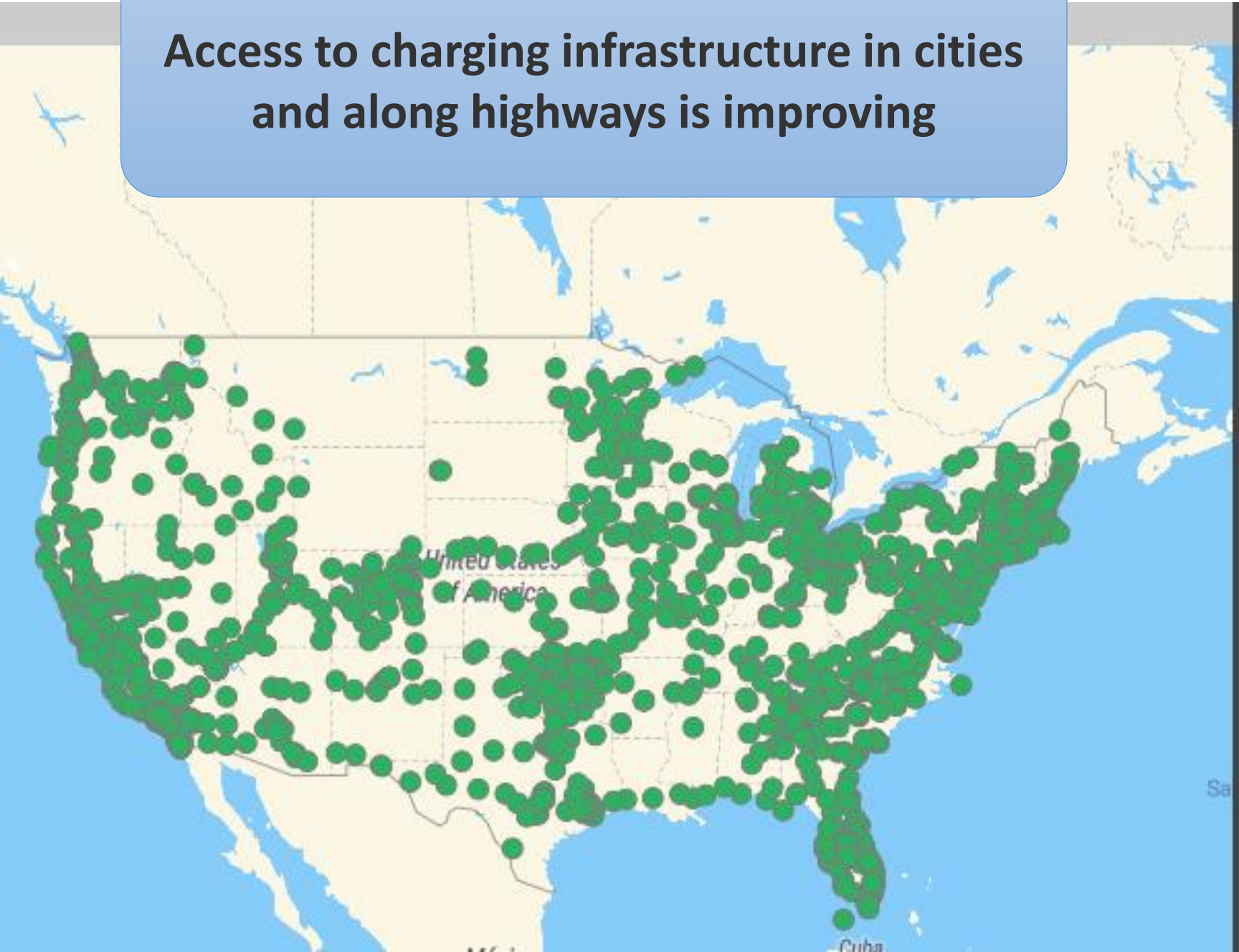
Historic: BNEF



Projections: ICCT

AFDC Station Locator

Access to charging infrastructure in cities and along highways is improving



Edit Filters

2,803
stations

5,885
charging outlets

Filters chosen:

United States

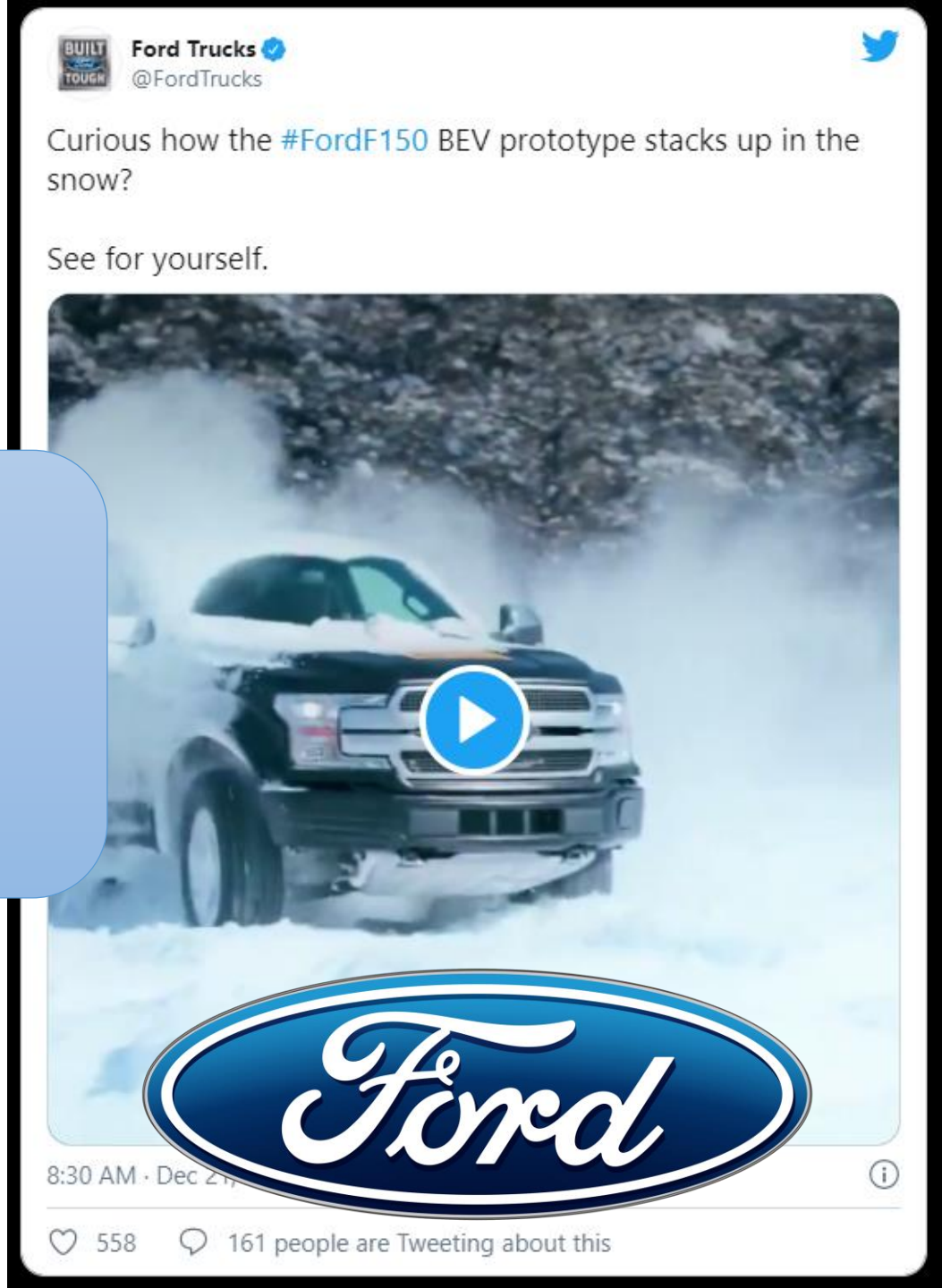
Electric

Types: DC Fast

Connectors/outlets: CCS

Access: Public

EV model availability is increasing



Transit Bus Electrification

- Transit authorities have been early adopters of heavy-duty EVs
- High-VMT, fixed route operation tends to be ideal for electrification
- Allows fleets to take advantage of EV low operating costs
- Predictable schedule alleviate the need for fast charging

NREL-Hosted Event Supports Industry Development of Megawatt Charging System Connectors

Oct. 12, 2020

Heavy-duty electric trucks (and charging) coming soon…

PEV Charging Analysis – NREL Objective

Provide guidance on plug-in electric vehicle (PEV) charging infrastructure to regional/national stakeholders to:

- Reduce range anxiety as a barrier to increased PEV sales
- Ensure effective use of private/public infrastructure investments

Some key questions related to investment in PEV charging stations…

How many?

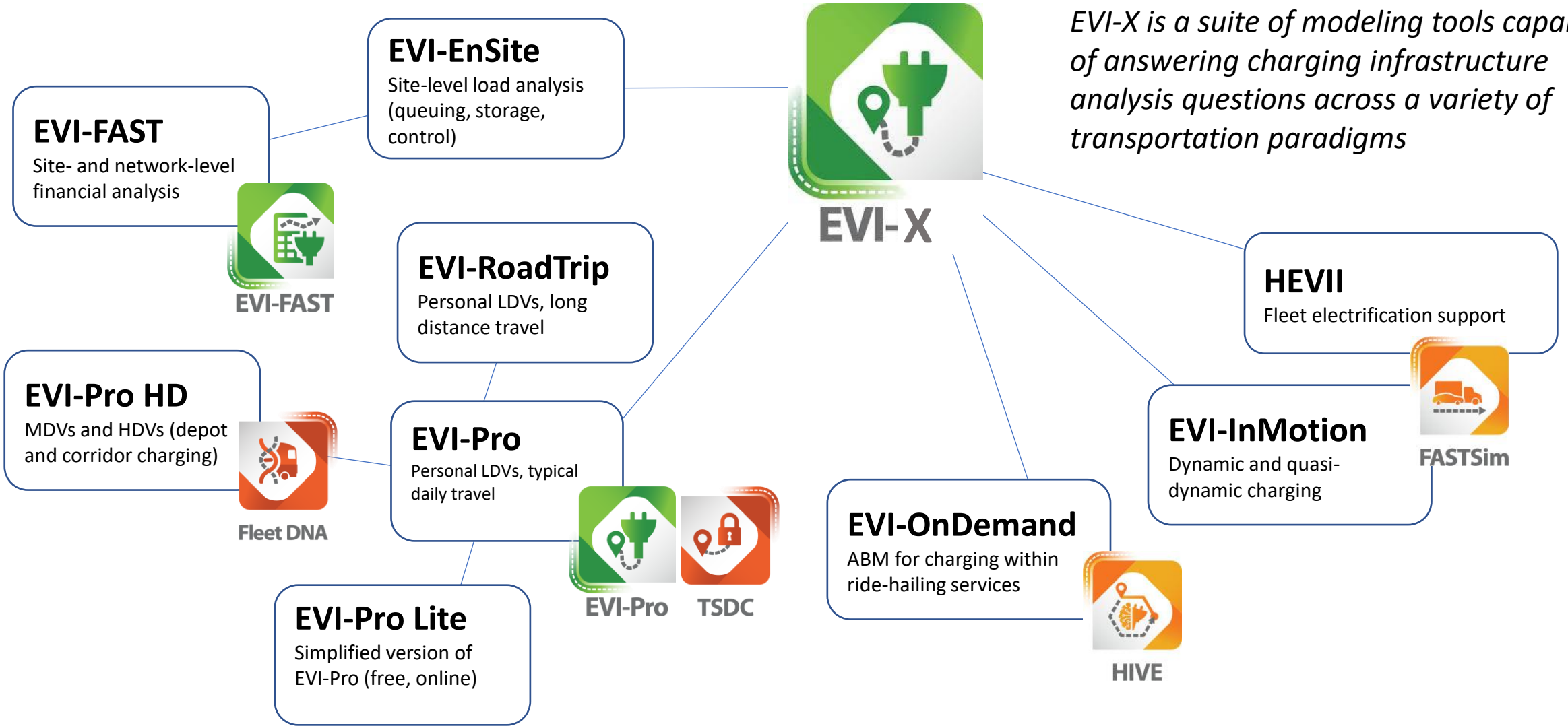
What kind?

Where?

Recent Studies

California (2014)
Seattle, WA (2015)
Massachusetts (2017)
Colorado (2017)
National Analysis (2017)
Columbus, OH (2018)
California (2018)
Maryland (2019)

NREL Charging Infrastructure Analysis Capabilities



EVI-X is a suite of modeling tools capable of answering charging infrastructure analysis questions across a variety of transportation paradigms

EVI-Pro Lite for Estimating Bulk Load Impacts

- **Objective:** Make analytic capabilities of EVI-Pro model accessible to broad group of stakeholders for planning and analysis.
- **Approach:** Develop a simplified, web-based interface for EVI-Pro that gives users access to a limited number of critical input variables. Simultaneously expose APIs that enable large-scale parameter sweeps. Updates performed in collaboration with LBNL and Humboldt State University with DOE support (VTO and SPIA).

Significance & Impact

Since its launch, 6,000 users have viewed 14,000 pages on the tool, spending almost 4 minutes per visit.

afdc.energy.gov/evi-pro-lite

Electric Vehicle Infrastructure Projection Tool (EVI-Pro) Lite

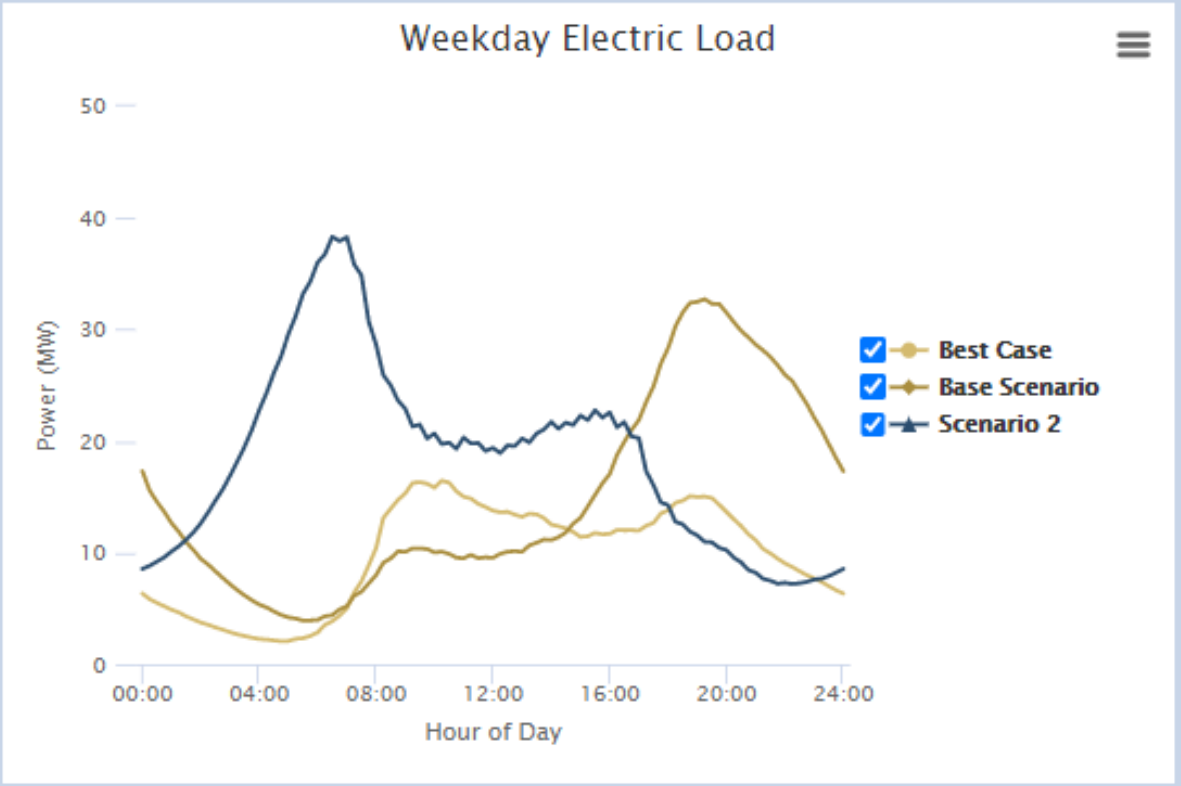
This tool provides a simple way to estimate how much electric vehicle charging you might need and how it affects your

Charging Need | Load Profile

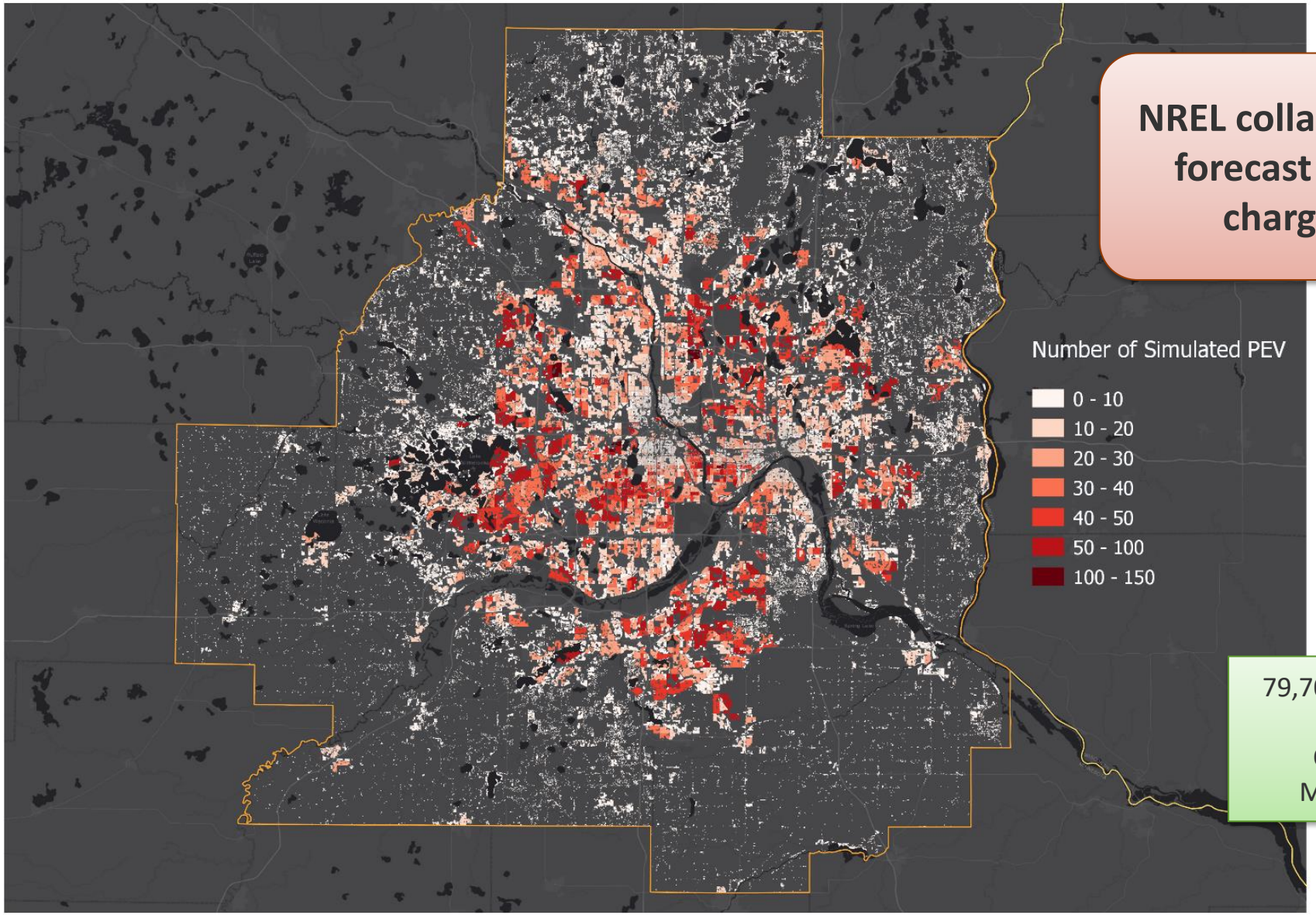
How Does Vehicle Charging Affect My Charging Load Profile?

Results for Lawrence, Kansas

In the Lawrence area, supporting a fleet of 30,000 plug-in electric vehicles would result in the following electric load profile:



Impacts to Distribution Networks



NREL collaboration with Xcel Energy to forecast distribution impacts of EV charging in Minneapolis, MN

79,700 PEVs across 57,310 features
Avg 1.4 PEVs / feature
One feature with 150 PEVs
Median feature area = 1 acre


Thanks! Questions?
www.nrel.gov
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