EVI-Pro Lite Updates Webinar

Eric Wood | Lauren Spath Luhring | Matt Rahill

December 9, 2020

Presenters

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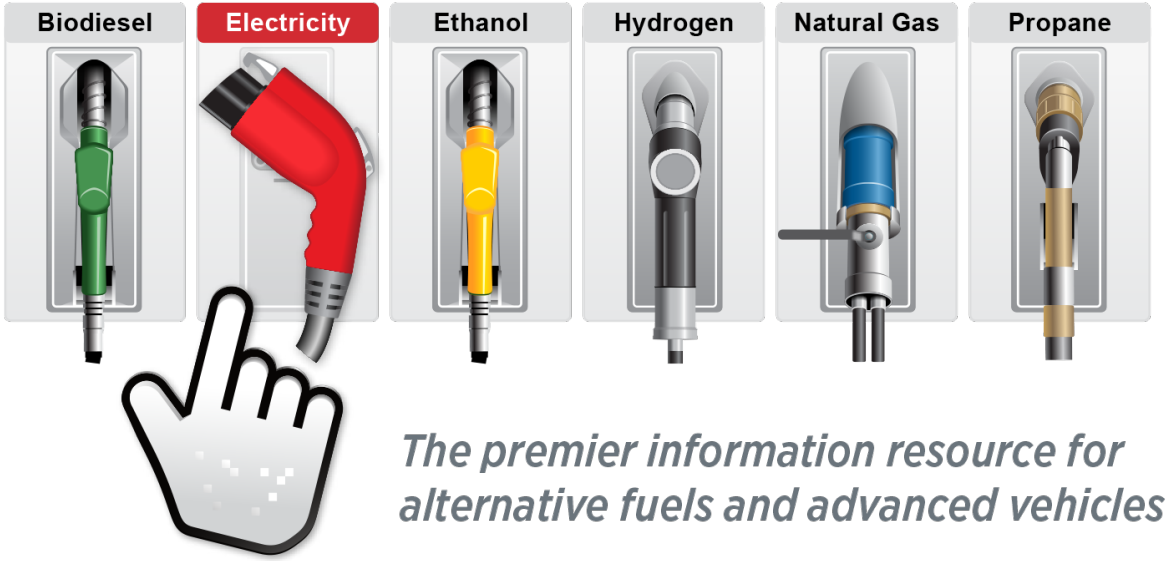
Agenda

1. AFDC Introduction
2. EVI-Pro Model & Load Profile Scenarios
3. Demo of the Tool and API
4. Local Opportunities
5. Q&A

Alternative Fuels Data Center



The premier information resource for alternative fuels and advanced vehicles

afdc.energy.gov

Who uses the AFDC?

Fleet managers

Transportation planners

Fuel providers

Utilities

Clean Cities coalitions

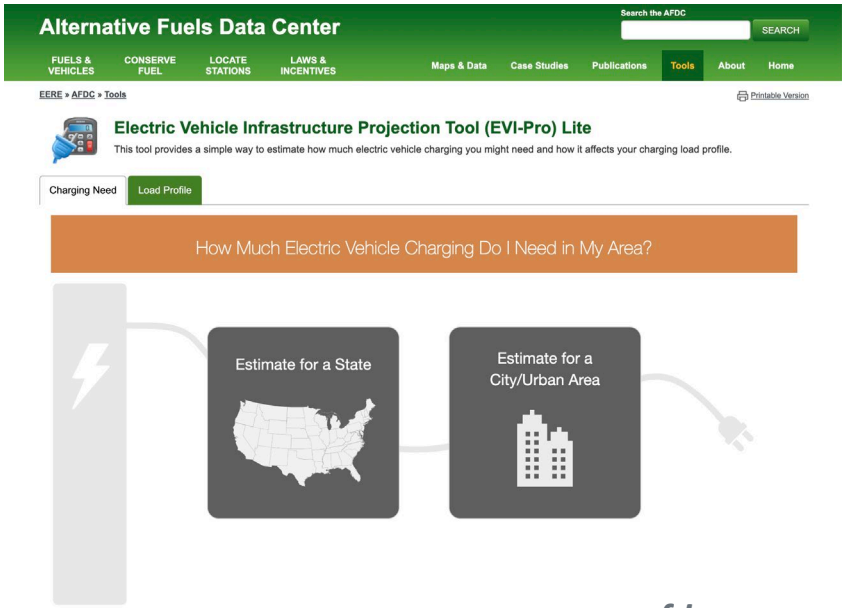
3 million
users annually

12 million
pageviews annually

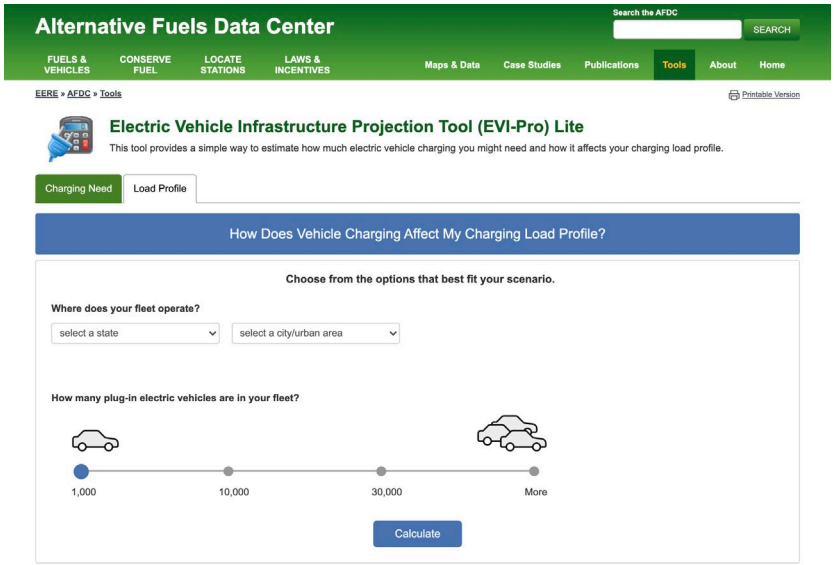
25 million
station searches annually

EVI-Pro Lite

Charging Need

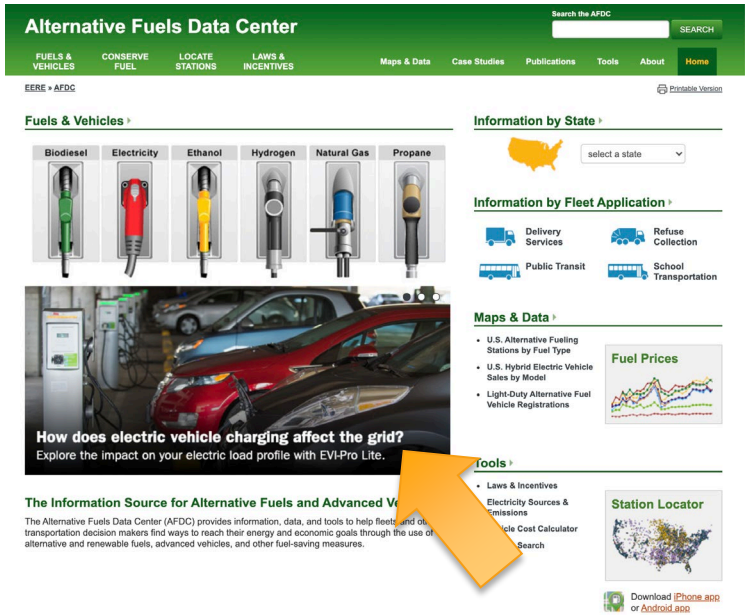


Load Profile

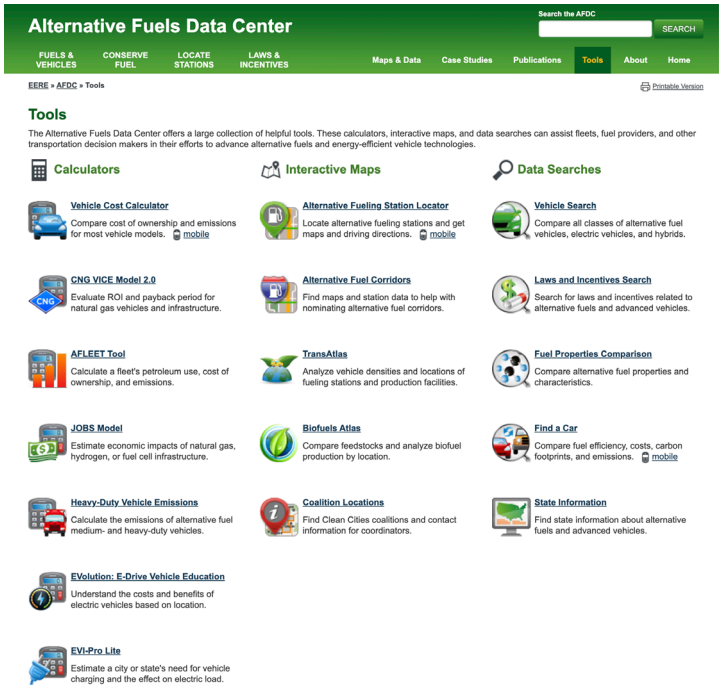


afdc.energy.gov/evi-pro-lite

Home Page



Tools Page



EVI-Pro Model &
Load Profile Scenarios

The EV Infrastructure Projection Tool

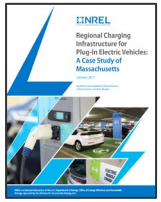
EVI-Pro

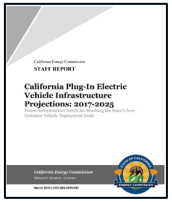
Simulation model to:

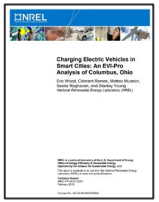
- Estimate charging **demand** from EVs
- Design **supply** of infrastructure

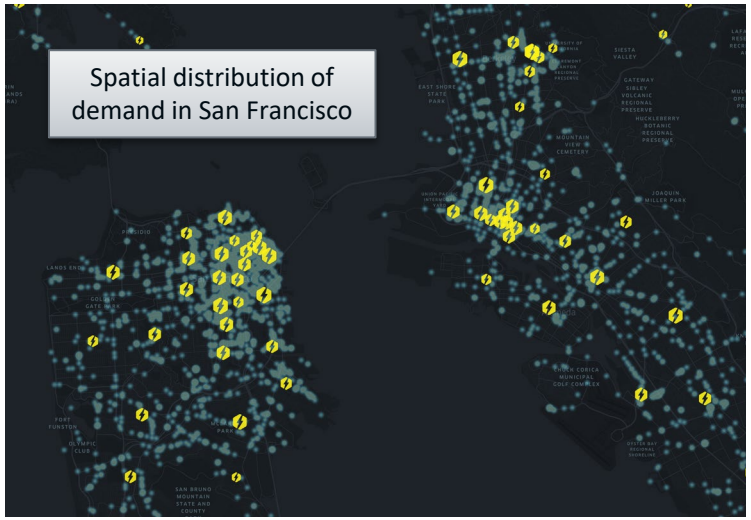
Informed by real-world data and integrated with models of vehicle adoption, mobility, station economics, and the grid

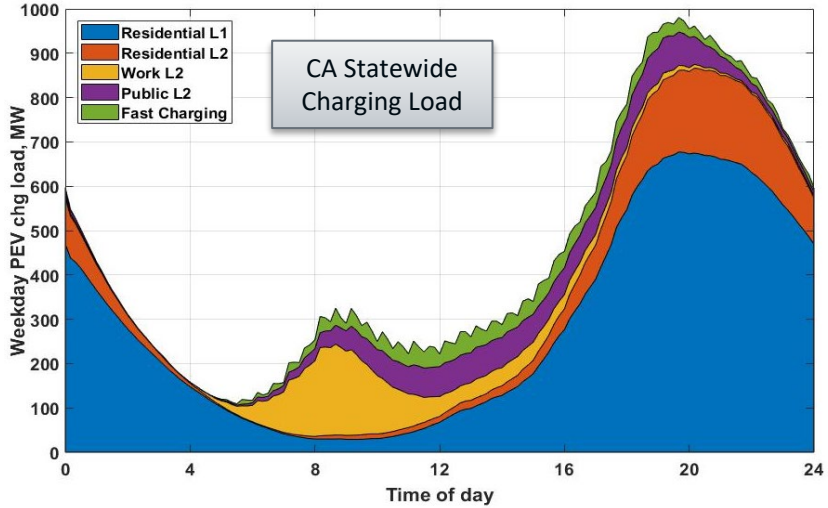
Originally developed through collaboration with the California Energy Commission and since applied at the city-, state-, and national-level

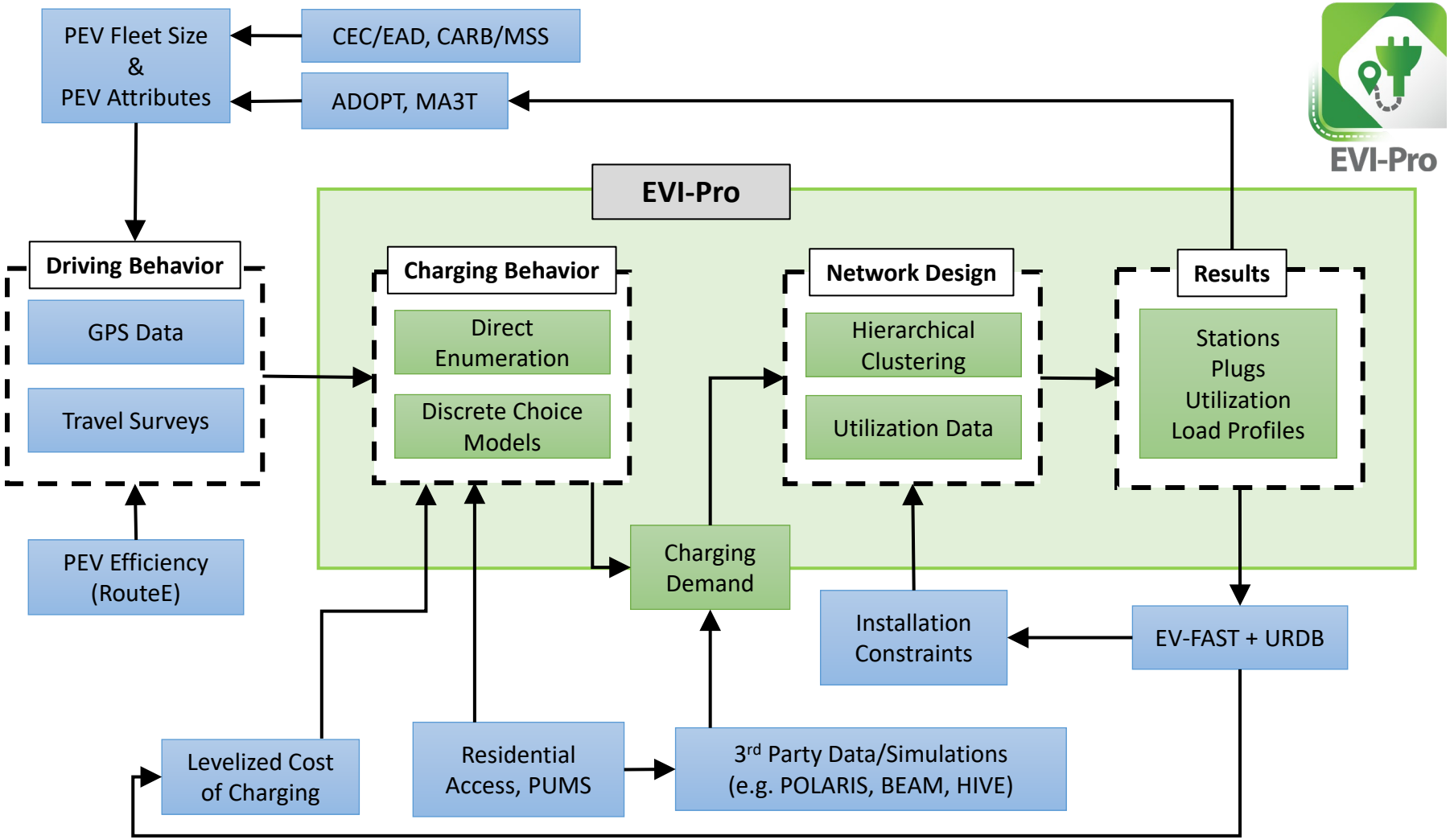











PEV Fleet Size & PEV Attributes
CEC/EAD, CARB/MSS
ADOPT, MA3T
EVI-Pro
EVI-Pro
Driving Behavior
GPS Data
Travel Surveys
PEV Efficiency (RouteE)
Charging Behavior
Direct Enumeration
Discrete Choice Models
Network Design
Hierarchical Clustering
Utilization Data
Results
Stations
Plugs
Utilization
Load Profiles
Charging Demand
Installation Constraints
EV-FAST + URDB
Levelized Cost of Charging
Residential Access, PUMS
3rd Party Data/Simulations (e.g. POLARIS, BEAM, HIVE)

Bottom Up EVI-Pro Driving / Charging Simulations

EVI-Pro

Travel Data

Departure	Arrival	Miles	Destination
7:00 AM	7:45 AM	30	Public
9:30 AM	10:30 AM	30	Public
12:45 PM	3:00 PM	100	Public
4:00 PM	5:00 PM	40	Home

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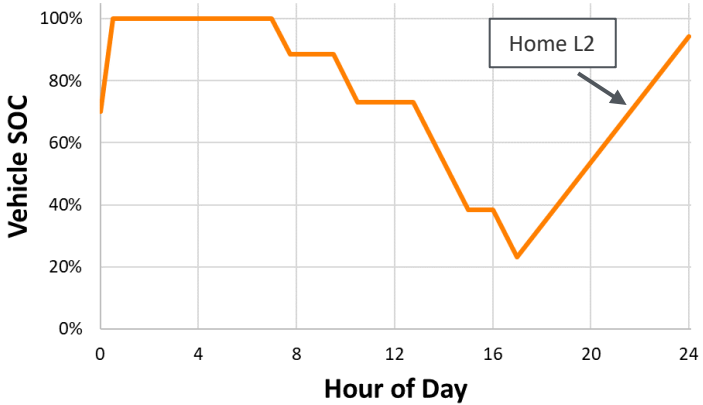
Sample Vehicle / Infra Assumptions:

- 250 mile BEV
- DCFC = 50kW
- L2 = 7.2kW

Sample Choice / Access Assumptions:

- Charge every night, home dominant

Driving, Charging Simulations



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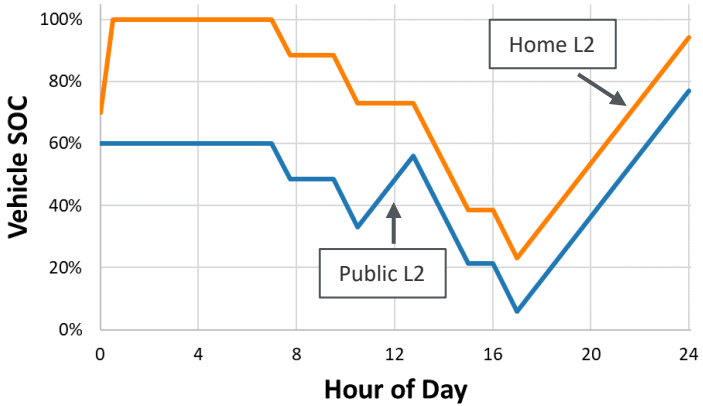

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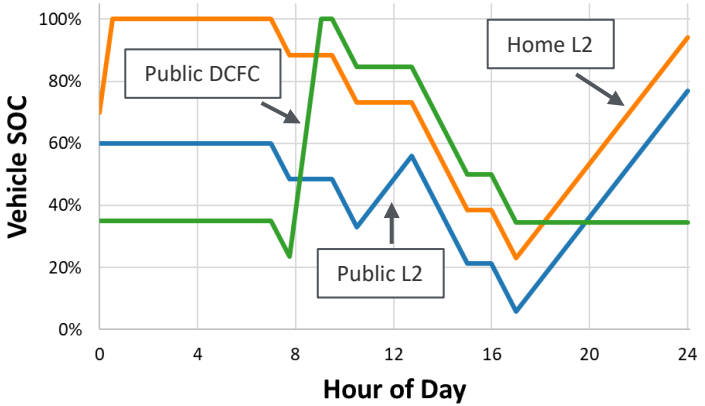

Bottom Up EVI-Pro Driving / Charging Simulations

EVI-Pro

Travel Data | **Discovered, Simulated Charge Events**

Departure	Arrival	Miles	Destination	Driver A	Driver B	Driver C
7:00 AM	7:45 AM	30	Public	None	None	Public DCFC
9:30 AM	10:30 AM	30	Public	None	Public L2	None
12:45 PM	3:00 PM	100	Public	None	None	None
4:00 PM	5:00 PM	40	Home	Home L2	Home L2	None

Charging demand to satisfy travel

Sample Vehicle / Infra Assumptions:

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- DCFC = 50kW
- L2 = 7.2kW

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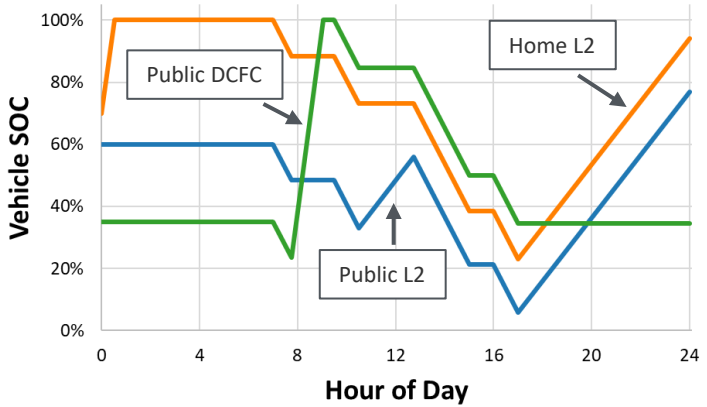


Online PEV Infrastructure Tool: EVI-Pro Lite

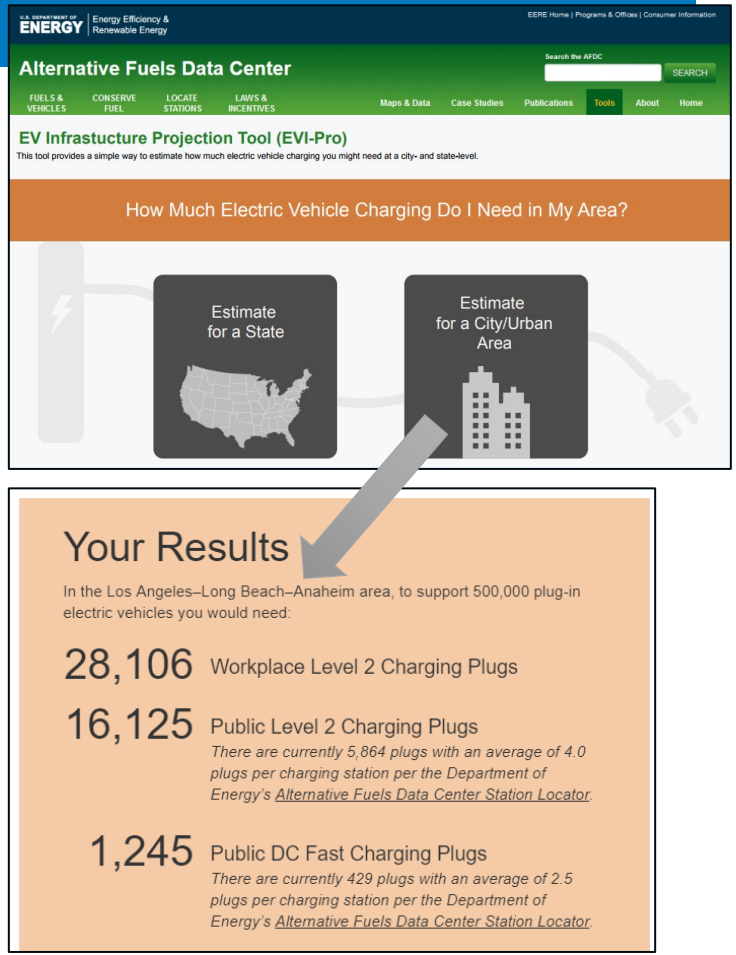
Objective: Make analytic capabilities of EVI-Pro model accessible to broad group of stakeholders for EVSE investment decisions.

Approach: Develop a simplified, web-based interface for EVI-Pro that gives users access to a limited number of critical input variables.

Significance & Impact

- EVI-Pro "unlocks" an unlimited number of scenarios for planners to explore regarding EV charging infrastructure requirements.
- Ability to rapidly develop scenarios and explore sensitivities will help users understand the key drivers for investment.

afdc.energy.gov/evi-pro-lite



EVI-Pro Lite: Providing complex modeling to a broad audience

EVI-Pro Lite simplifies demand modeling, enabling partners to create tailored scenarios for state or city charging infrastructure.

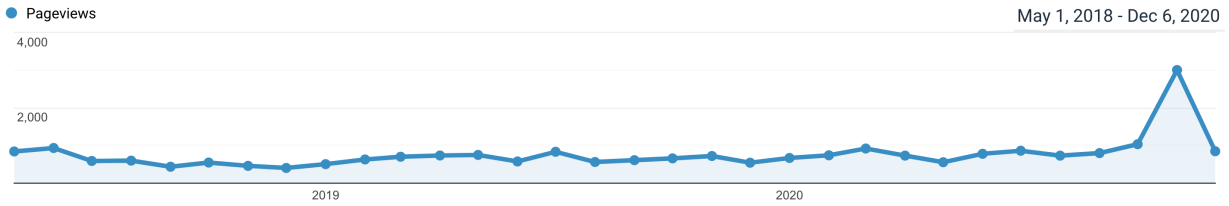
Building Partnerships

What are partners doing with the EVI-Pro Lite?

- FHWA has highlighted the tool during state convenings on nominating electric alternative fuel corridors
- Hawaiian Electric Company built a case for infrastructure investment for the public utilities commission
- Broward County, Florida directs consultants to use the tool for electric vehicle infrastructure strategies
- Tesla uses the tool in discussions with cities around public infrastructure investments
- NYSERDA planned infrastructure investment and has developed an ongoing partnership with NREL

Measuring Success

Since its launch, 10,000 users have viewed 24,000 pages on the tool, spending almost 3.5 minutes per visit.

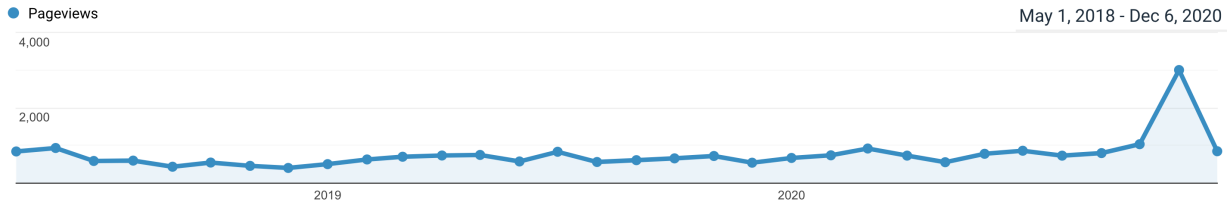


EVI-Pro Lite: Providing complex modeling to a broad audience

EVI-Pro Lite simplifies demand modeling, enabling partners to create tailored scenarios for state or city charging infrastructure.

"Municipal and regional governments typically do not have the resources to understand their charging infrastructure needs. Having a quick online tool that gives a ballpark estimate of charging needs is a deeply helpful service. I've witnessed first-hand the amazement when city level sustainability staff first use EVI-Pro Lite."

-DOE 2019 Annual Merit Reviewer

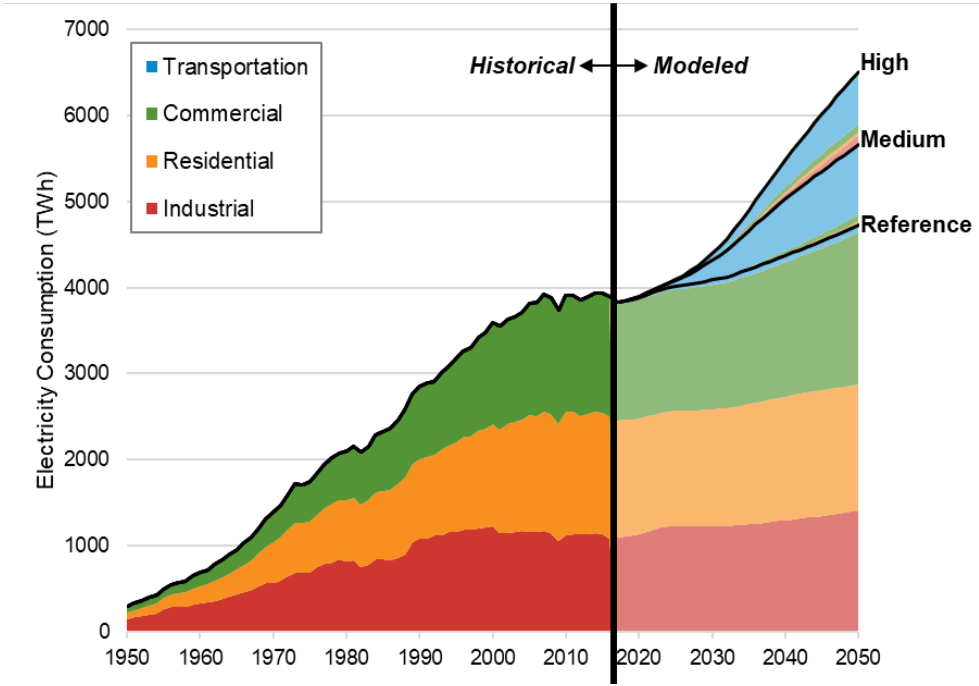


US Electricity Demand Scenarios

NREL Electrification Futures Study scenarios project great degree of transportation electrification, in line with several energy system transformation scenarios

EFS High scenario, 2050

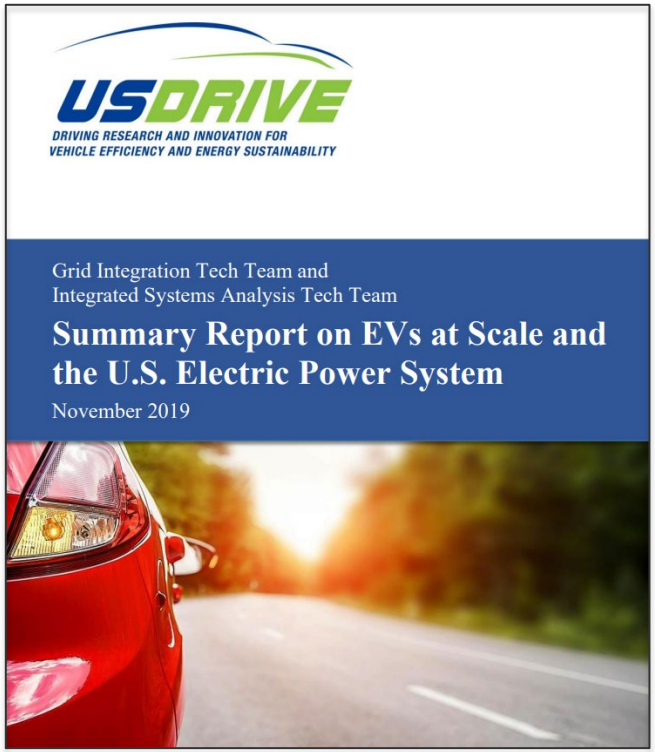
- Transportation share of electricity use increases from 0.2% in 2018 to 23% of electricity consumption in 2050.
- 1,424 TWh increase in transportation-related electricity consumption relative to the 2050 Reference scenario.

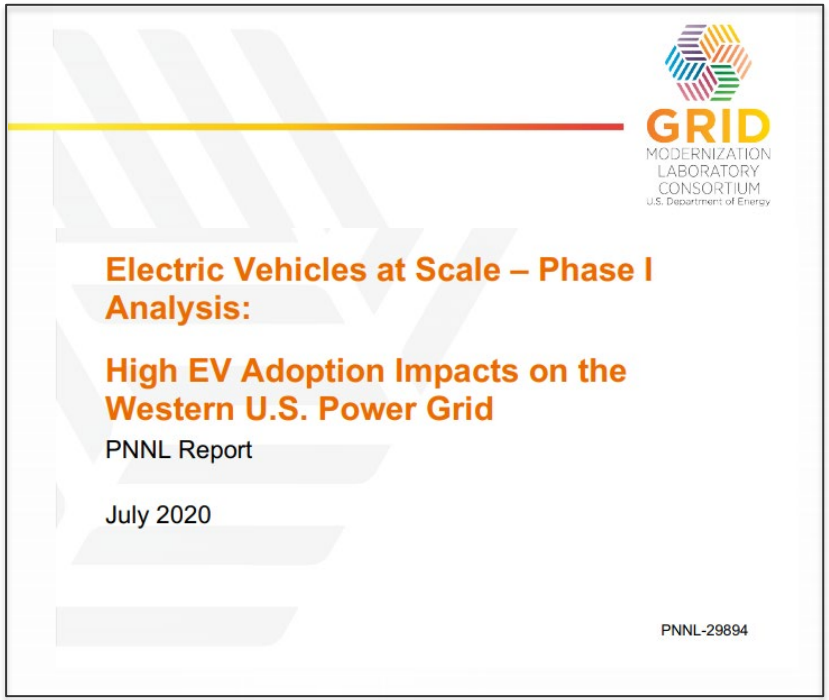


Source: https://www.nrel.gov/analysis/electrification-futures.html

“Are EVs going to break the grid?”

Broad use of EVI-Pro for grid impacts analysis…





“Unlock” EVI-Pro Load Profiles

With feedback from…

Electric utilities

Automotive manufacturers

Charging network companies

Local governments

Research institutes

With support from…

The US Department of Energy

In collaboration with…

Lawrence Berkeley National Laboratory

Schatz Energy Research Center at Humboldt State University

Expose users to projections in:

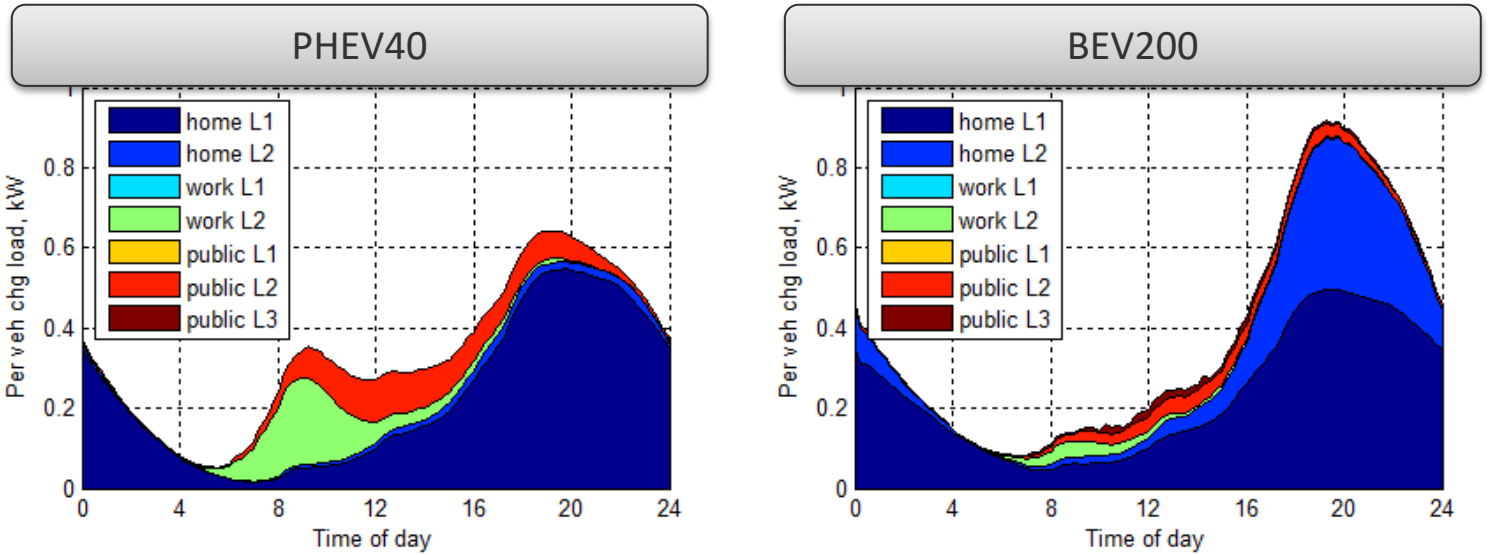
A Simplified Interface for Accessibility

A Programmatic Interface for Analysts

“Unlock” EVI-Pro Load Profiles

Emphasize significance of…

Vehicle Technology



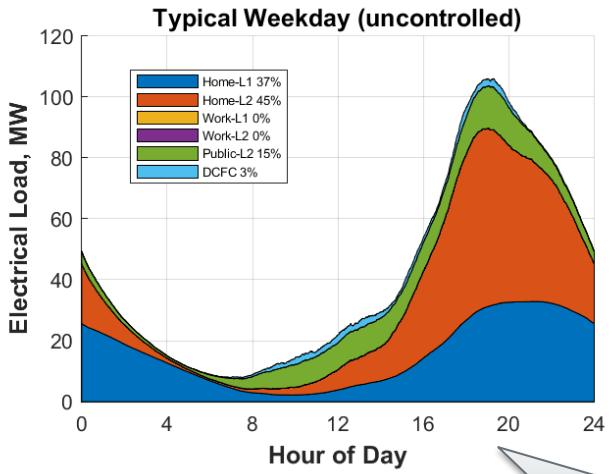
Simulated load from 300,000 EVs in Massachusetts

“Unlock” EVI-Pro Load Profiles

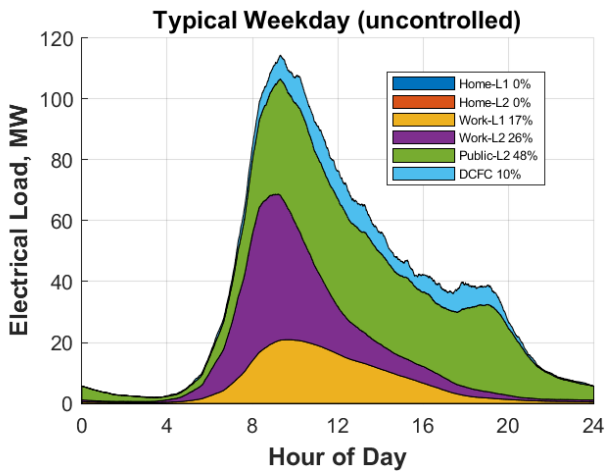
Emphasize significance of…

Residential Access

Home-Dominant Charging



No Home Charging



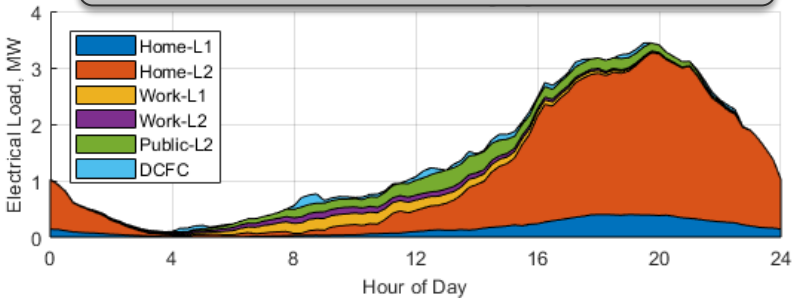
Simulated load from 120,000 EVs in Atlanta, GA

“Unlock” EVI-Pro Load Profiles

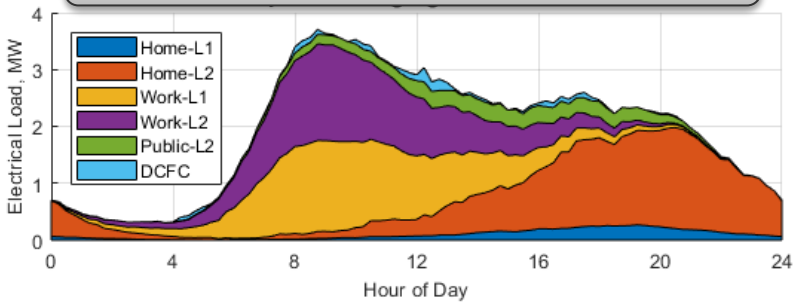
Emphasize significance of…

Charging Behavior

Home-Dominant Charging



Free Workplace Charging



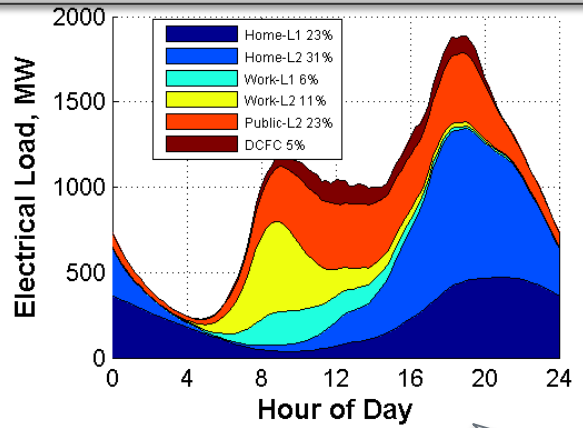
Simulated load from 4,000 EVs in Denver, CO

“Unlock” EVI-Pro Load Profiles

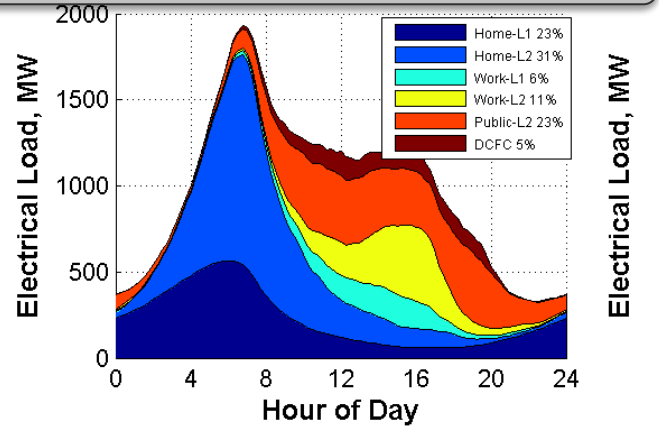
Emphasize significance of…

Load Flexibility

Charge as soon as possible



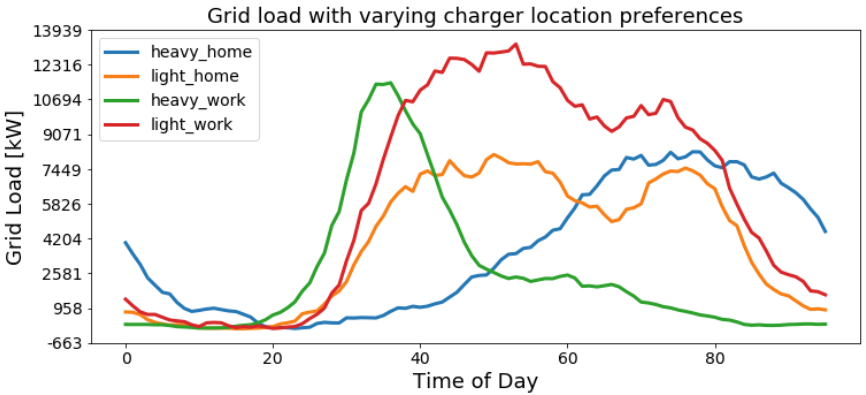
Charge as late as possible



Simulated load from 2M EVs in Los Angeles

Preview scenarios

Example Load Scenarios
(from NREL API)



15-min steps; midnight at 0 and 96; noon at 48

Exhaustive list of API input parameters

# of variable permutations: 13,122
# of files: 7 (for each temperature: -20,-10, 0, 10, 20, 30, 40)
Total permutations: 30,618

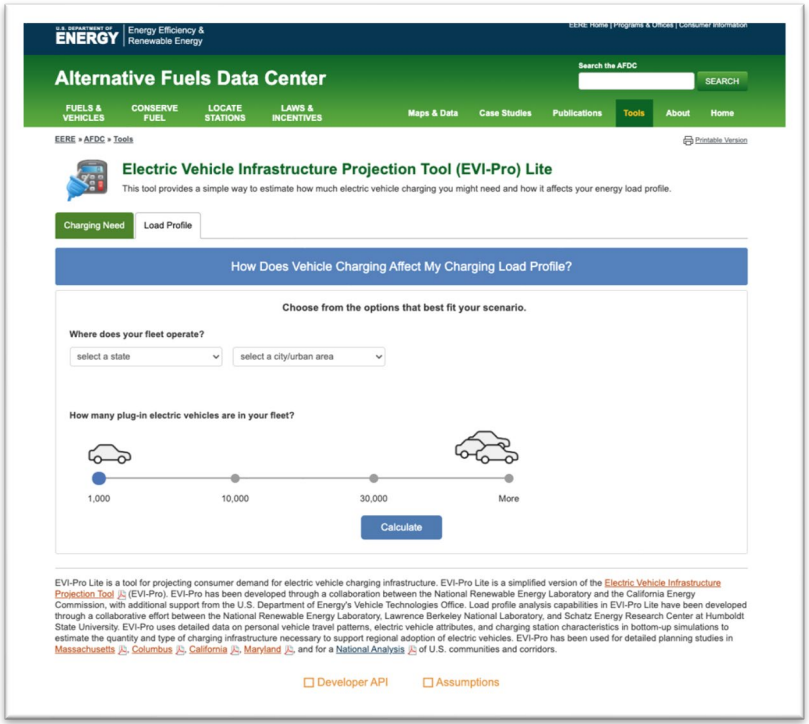
- Fleet size (3)
  - 1,000, 10,000, 50,000
- Average Fleet DVMT (3)
  - 25, 35, 45
- Temperature (7)
  - -20, -10, 0, 10, 20, 30, 40
- PEV Distribution (3) (Numbers correlate to % of vehicle type: PHEV20, PHEV50, BEV100, BEV250)
  - BEV Dominant = 10/15/25/50
  - PHEV Dominant = 25/50/10/15
  - PHEV/BEV Equal Shares = 15/35/15/35
- Vehicle Class (3)
  - Sedan dominant = 80/20
  - Equal distribution = 50/50
  - SUV dominant = 20/80
- Day of Week (2): weekday, weekend
- Home Access and Power (9)
  - 100% have access to home power (reflects region with high fraction of single family homes[1]). Three additional options for home power
    - Most L1 (80% L1, 20% L2)
    - Most L2 (20% L1, 80% L2)
    - Even L2 (50% L1, 50% L2)
  - 75% have access to home power. Three additional options for home power
    - Most L1 (80% L1, 20% L2)
    - Most L2 (20% L1, 80% L2)
    - Even L2 (50% L1, 50% L2)
  - 50% have access to home power. Three additional options for home power
    - Most L1 (80% L1, 20% L2)
    - Most L2 (20% L1, 80% L2)
    - Even L2 (50% L1, 50% L2)
- **Work Power (3):**
  - **Most L2 (20% L1, 80% L2)**
  - **Even L2 (50% L1, 50% L2)**
  - **Most L1 (80% L1, 20% L2)**
- Home/Work Preference (3):
  - 100% prefer home
  - 80% prefer home
  - 60% prefer home

Demo of the Tool and API

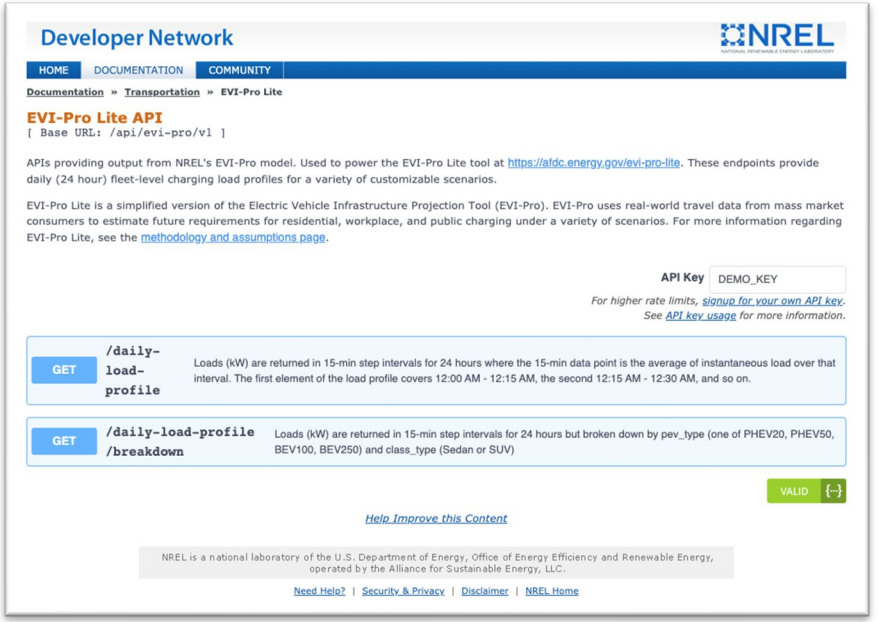
- afdc.energy.gov/evi-pro-lite/load-profile
- developer.nrel.gov/docs/transportation/evi-pro-lite-v1

EVI-Pro Lite – Load Profile

https://afdc.energy.gov/evi-pro-lite/load-profile

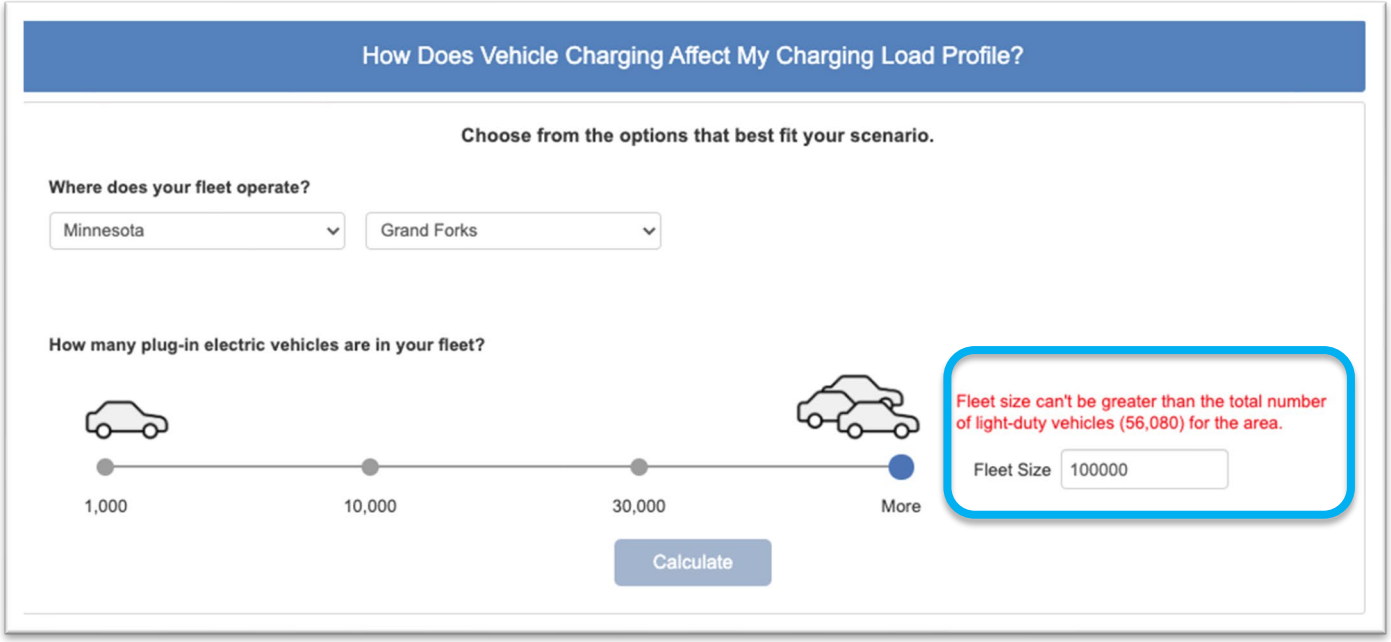


https://developer.nrel.gov/docs/transportation/evi-pro-lite-v1/



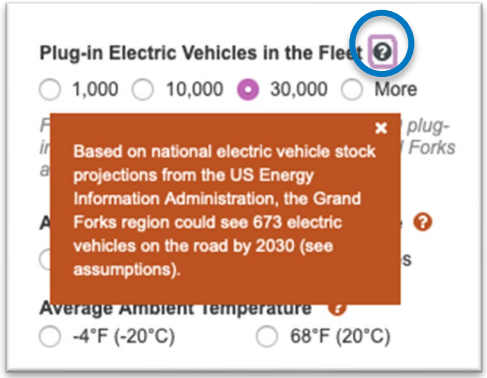
Initial form

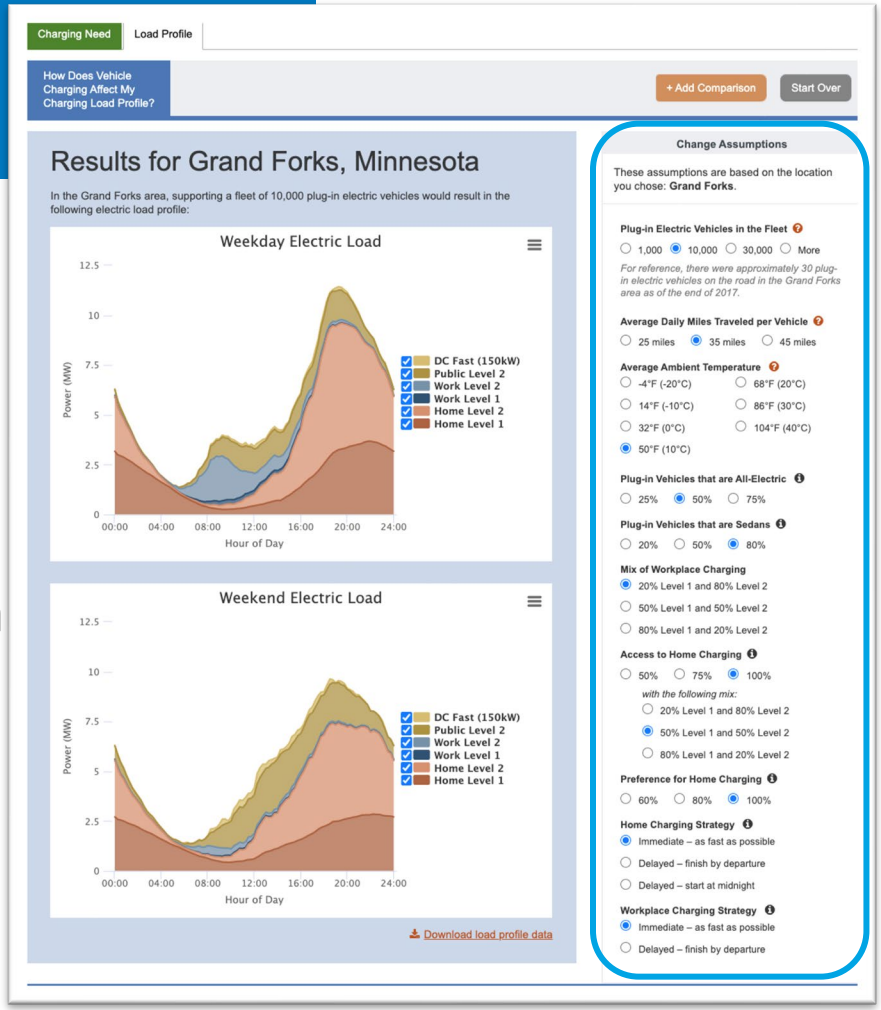
- Users select state and city/urban area on initial screen
- May choose a larger fleet size, but max fleet size is restricted to 100% of current light duty fleet



Results page

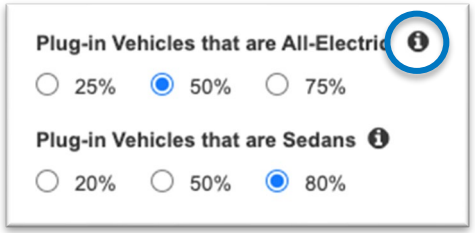
- Results show user inputs plus other default values
- All values may be edited
- Question mark icon on results page indicates more information is available

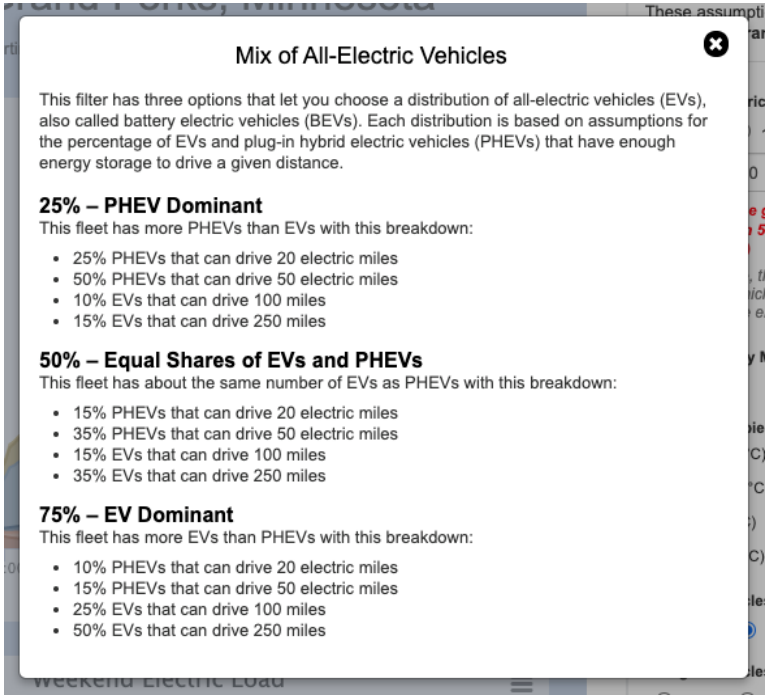




Results page

- Tooltips add context and clarification



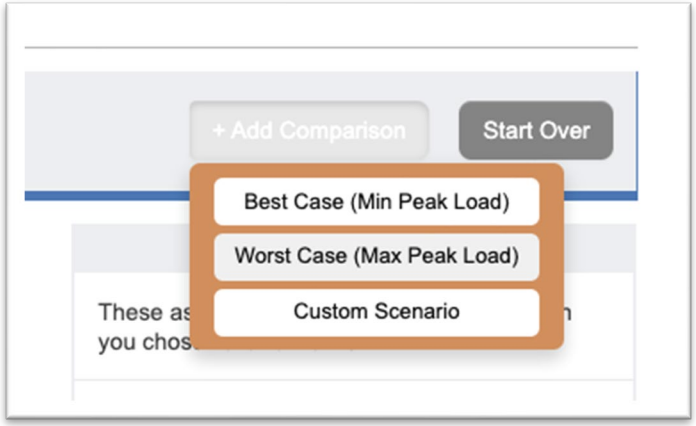


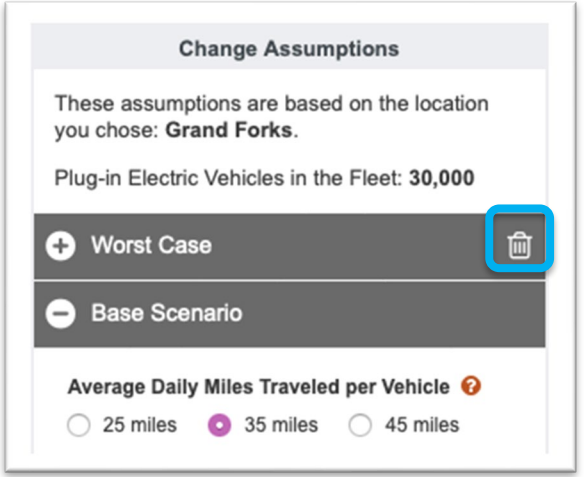
Results page

- Load profile charts are greyed out and Recalculate button appears any time changes are made to inputs
- Load profile shapes adjust once the Recalculate button is clicked

Multiple scenarios allowed

- Users can add or remove up to 5 comparison scenarios
- Pre-defined “Best” and “Worst” case scenarios cannot be edited, show minimum and maximum peak scenarios





Multiple scenarios

- When multiple scenarios are selected, charts change to a single line per scenario
- Hovering over chart shows time of day

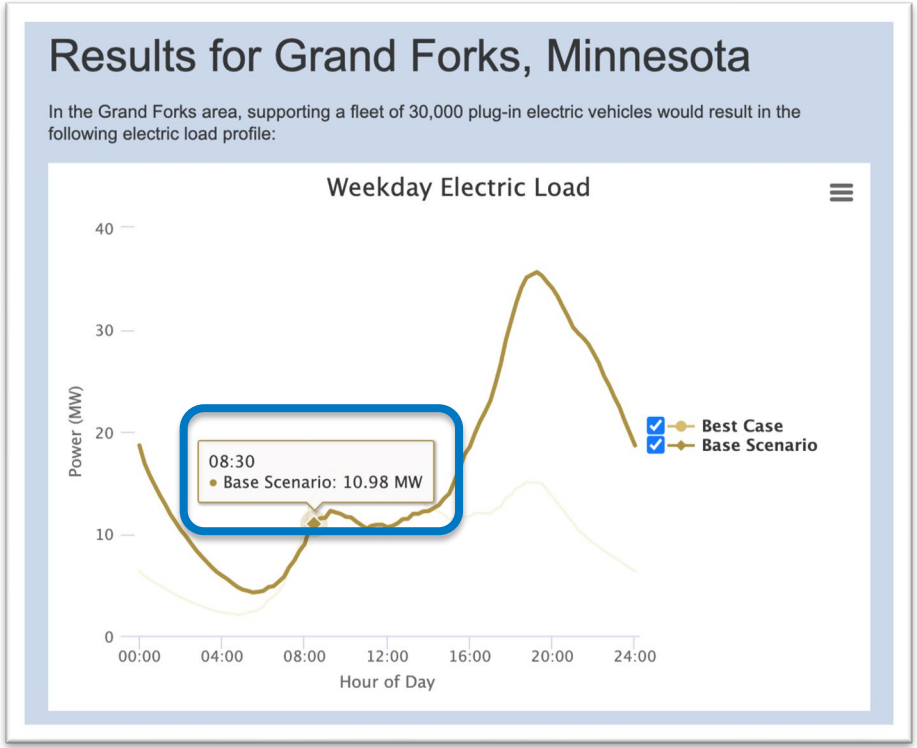
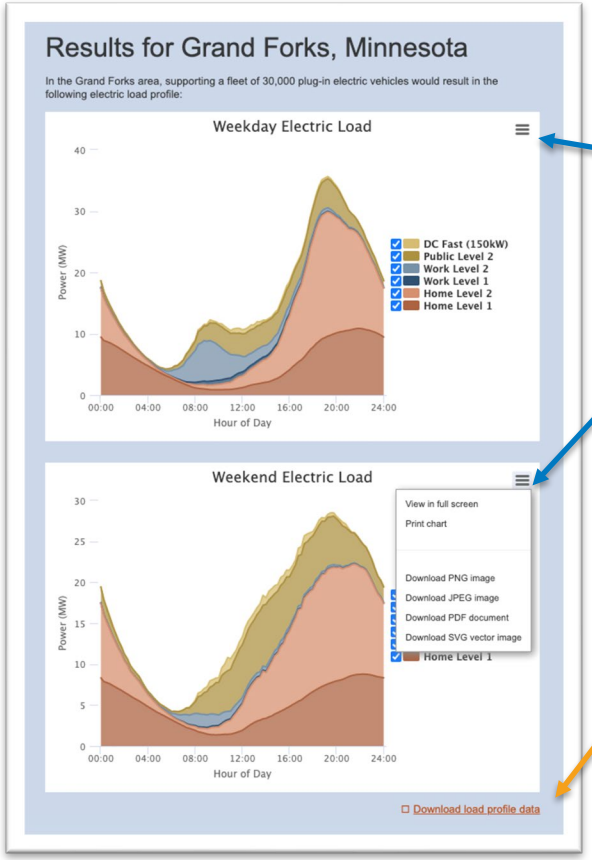


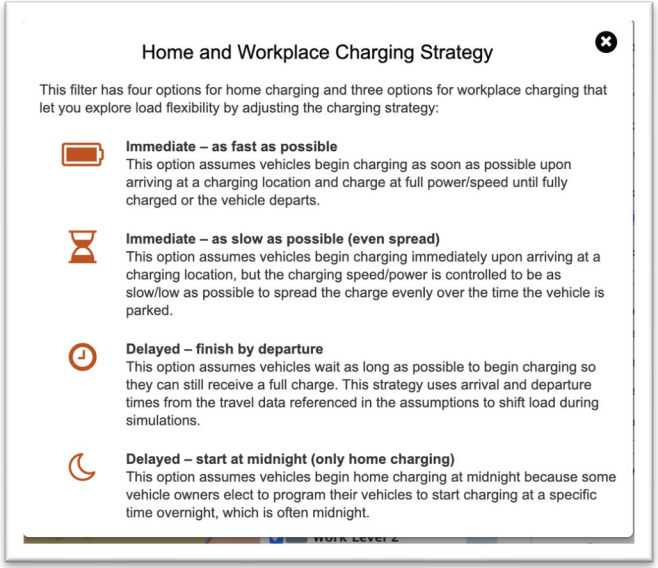
Chart and input downloads

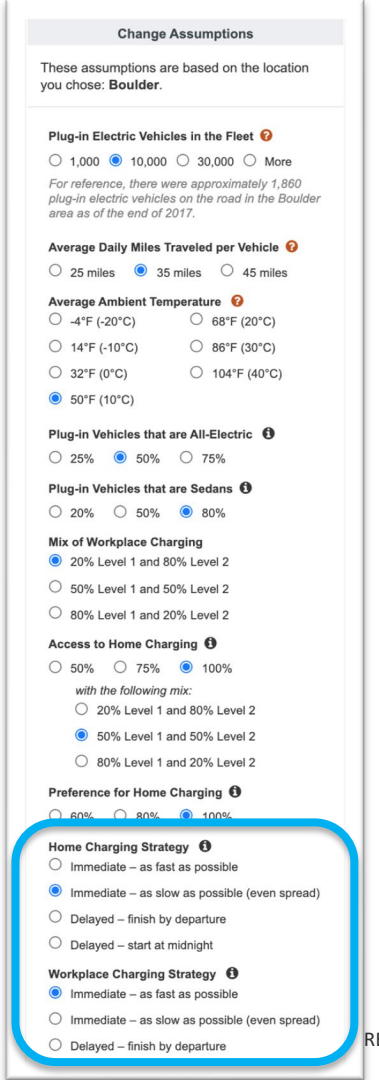


- Two downloads available:
  - Chart images (PNG, JPEG, PDF, or SVG)
  - Scenario inputs (CSV)

Load Flexibility

- Default scenario for EVI-Pro Lite is “minimum delay” – charging begins at full power/speed as soon as a user arrives at home or work and lasts until the vehicle is fully charged or unplugged
- Inputs to represent load flexibility demonstrate potential shifts in charging loads
- Tooltip defines charging strategies

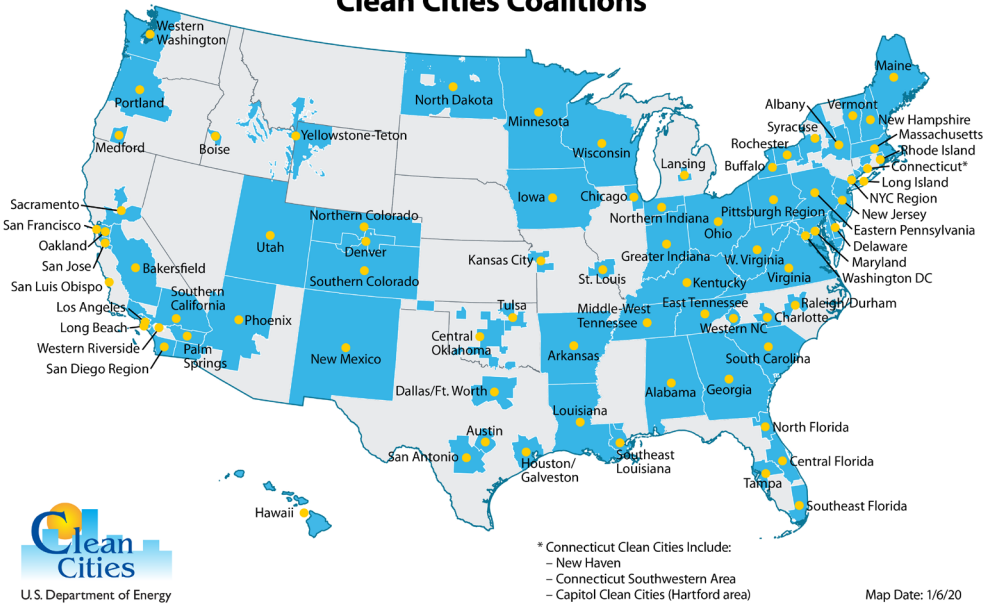




API and Methodology

- Assumptions and Methodology content provided from page footer (https://afdc.energy.gov/evi-pro-lite/load-profile/assumptions)
- API documentation for underlying APIs also linked from page footer (https://developer.nrel.gov/docs/transportation/evi-pro-lite-v1/)

Local Opportunities



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