

Advanced Smart Charging Infrastructure Planning Tool - ASCRIP

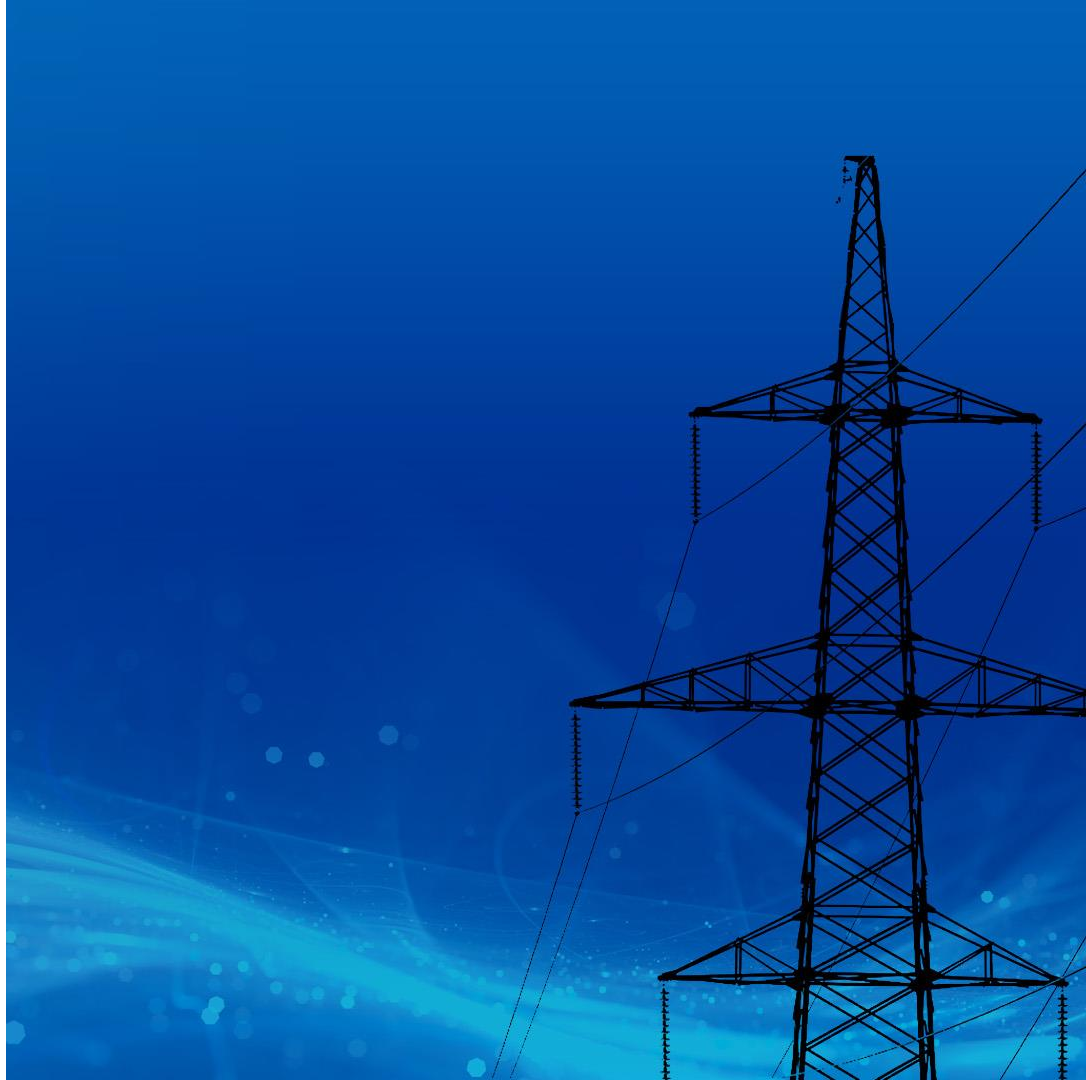
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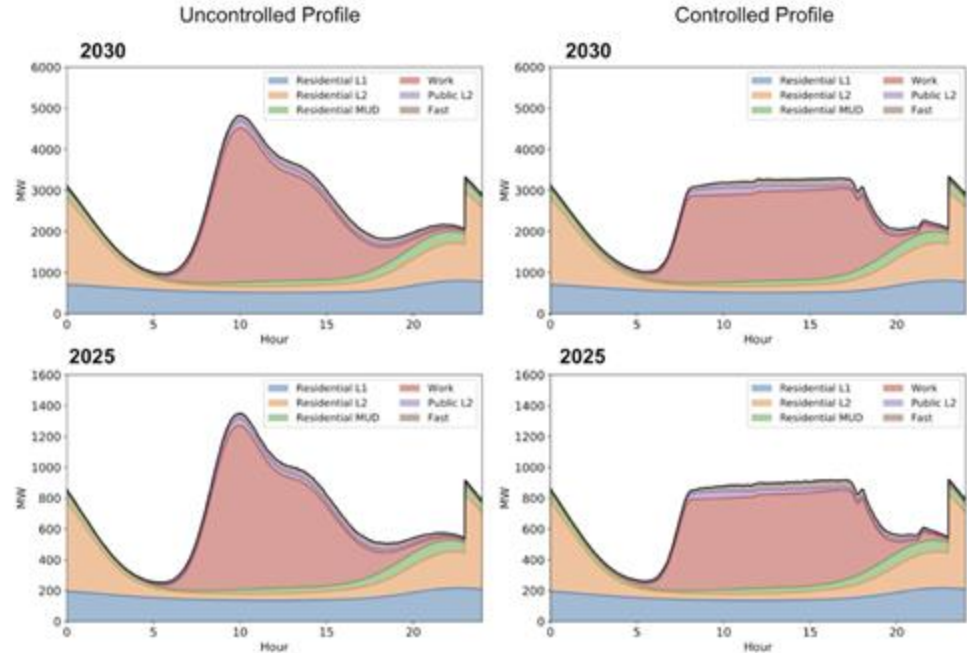
Office of Electricity

PNNL is operated by Battelle for the U.S. Department of Energy



Background

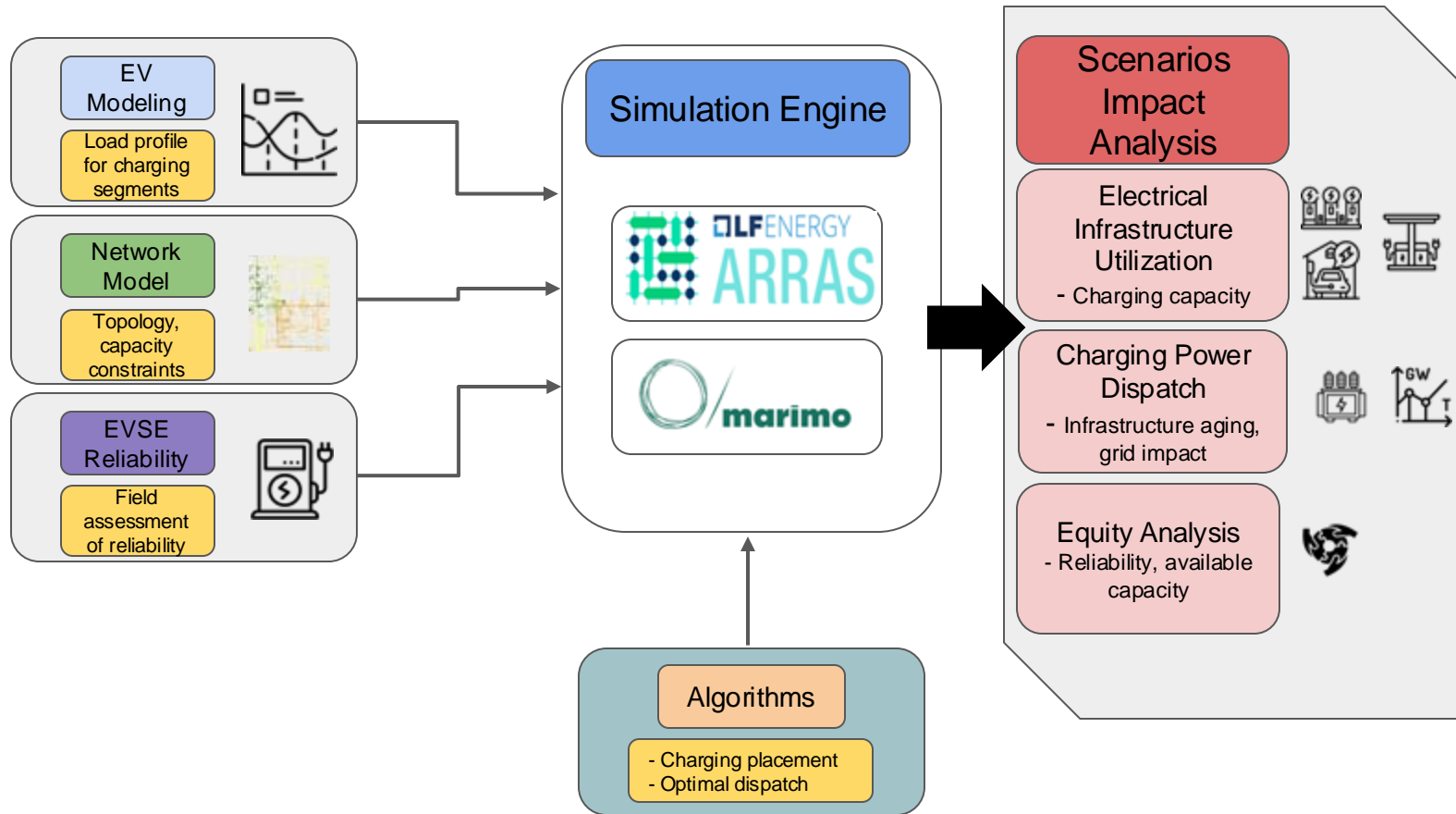
- Load growth for EV charging is challenging utilities ability to meet demand
- Energy supply and peak power require additional assets
- Controlled charging can mitigate peak power impacts on system assets
- System planning requires tools that can locate system impacts
- Allows trade-off of investments in controls with investments in assets



Scenario-based impact analysis tool:

- Build a data-driven understanding of EV demand (both location and size)
- Identify impacts of significantly expanded charging infrastructure
- Provide easy-to-use user interface to SPEECH model, including
 - National-scale, high-resolution, detailed break-down of existing and planned charging assets
 - Integration with distribution network simulations to identify "hot-spots"
 - Integration of charging control strategies to mitigate load growth impacts on networks
- Support outreach to utilities and researchers

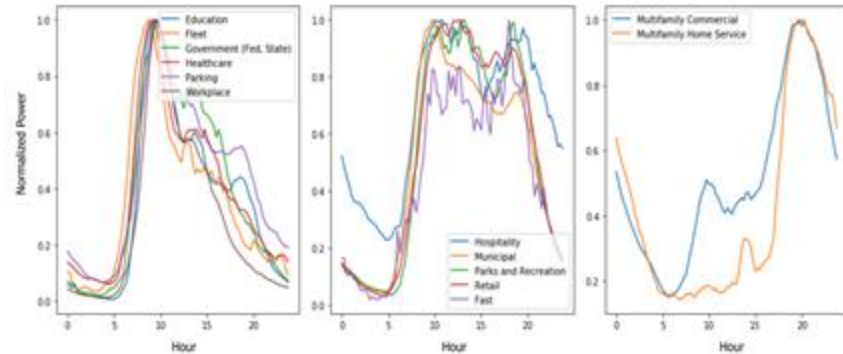
Approach



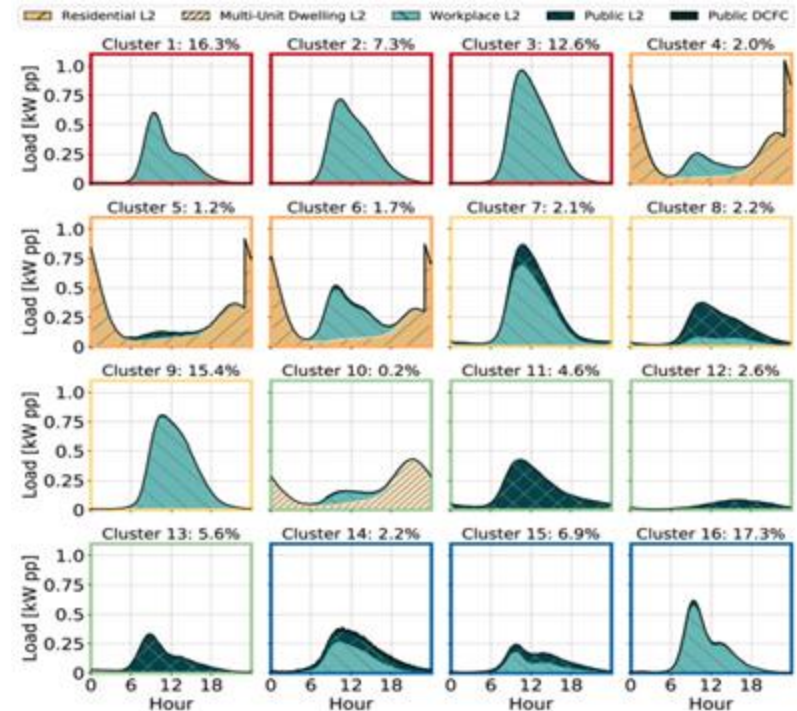
EV Modeling (1)

- General Statistics

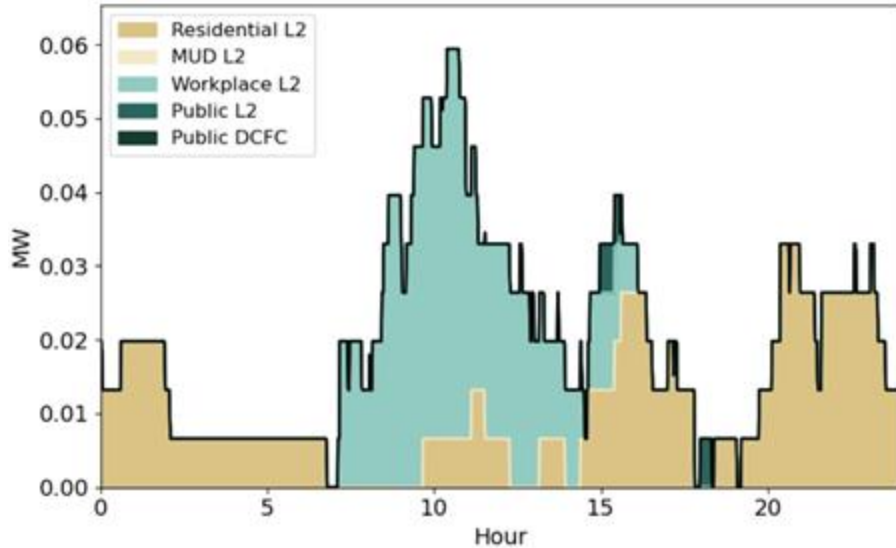
- 6.09mn sessions: 4.2mn from workplace, 521k residential single family, 148k multifamily, remaining from retail and public
- 119k unique drivers in 9 counties



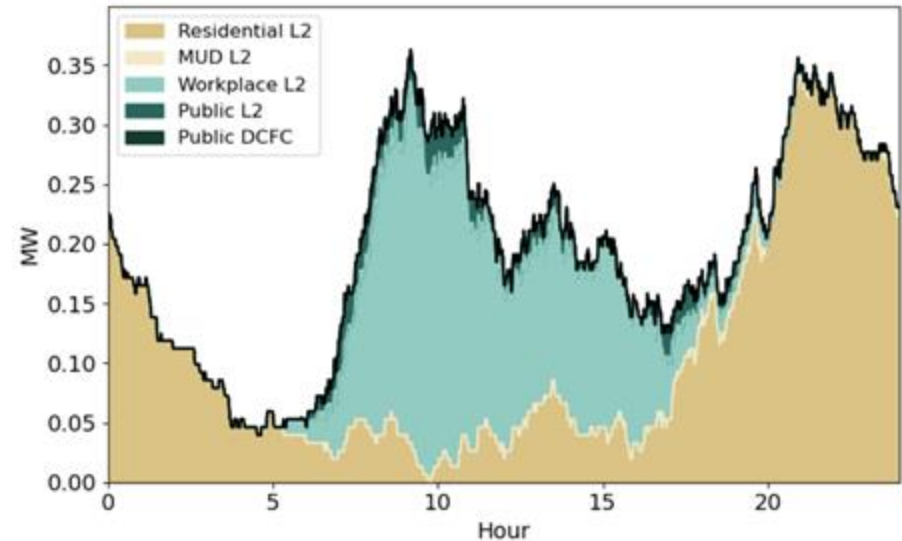
Clustered Segments



EV Modeling (2)



Total EVs: 100
50% sessions happening exclusively in workplace, 50%
happening residential+public



Total EVs: 1000
50% sessions happening exclusively in workplace, 50%
happening residential+public

sg2t 0.1.1

`pip install sg2t`

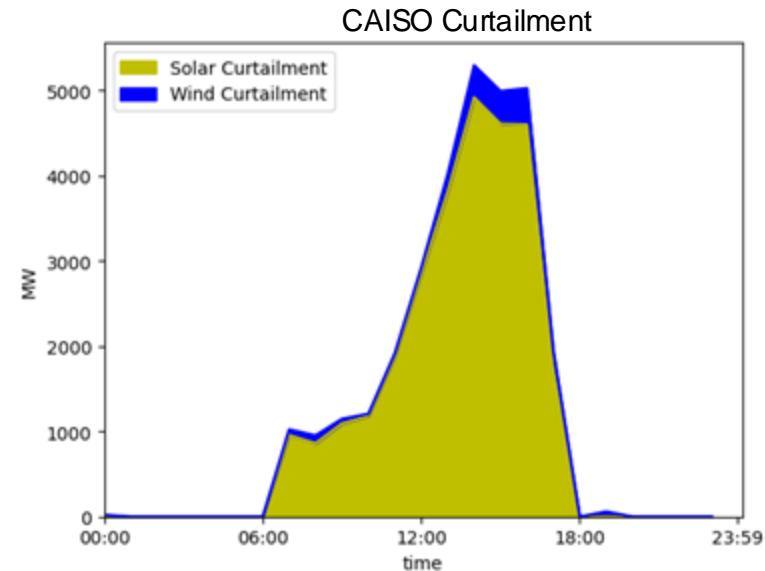
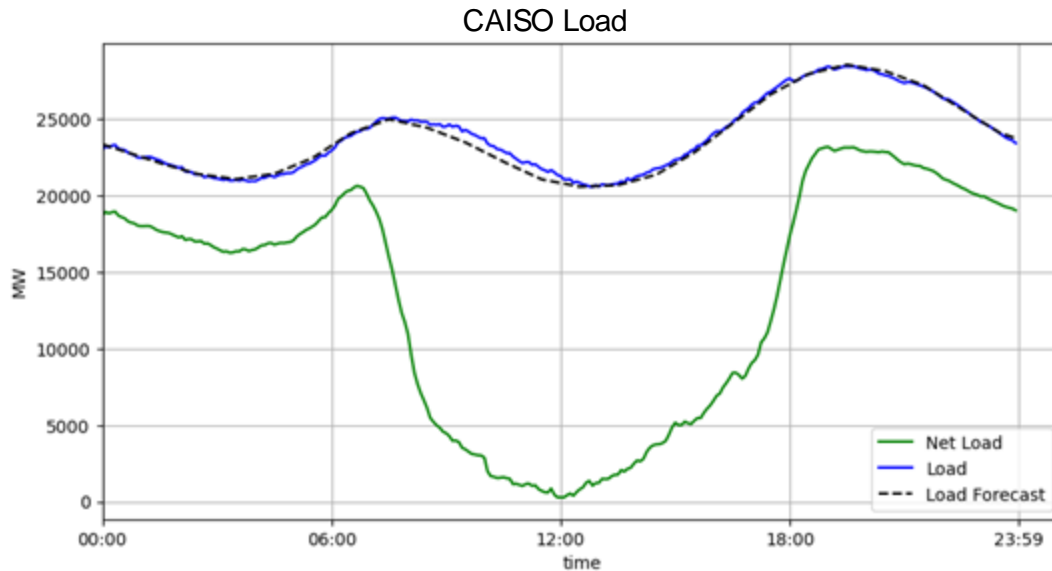
Two problems

1. Charging placement problem (long term infrastructure investment problem)
What is the total charging capacity at each node that maximizes utilization of the existing electrical infrastructure?
2. Optimal dispatch (near term infrastructure utilization problem)
What is the dispatch of charging power that minimizes degradation of the existing electrical infrastructure?

Algorithms (2)

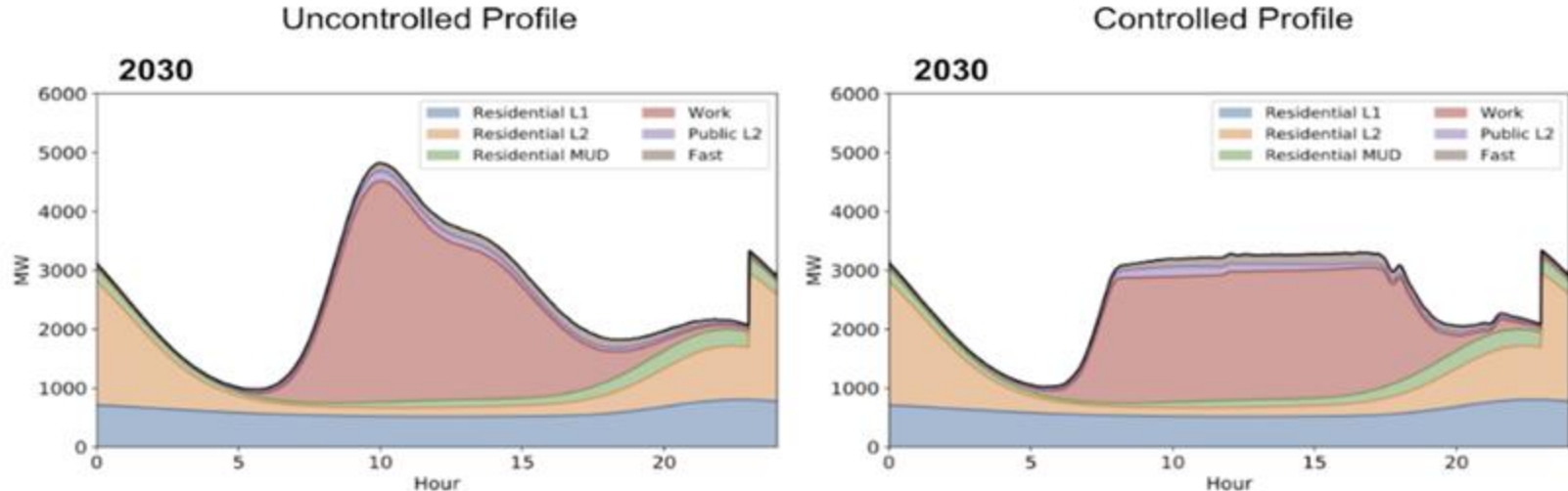
Charging placement problem (long term infrastructure investment problem)

Charging placement heuristics implemented in Arras Energy as a function of available grid capacity and location.



Optimal dispatch (near term infrastructure utilization problem)

What is the dispatch of charging power that minimizes degradation of the existing electrical infrastructure?

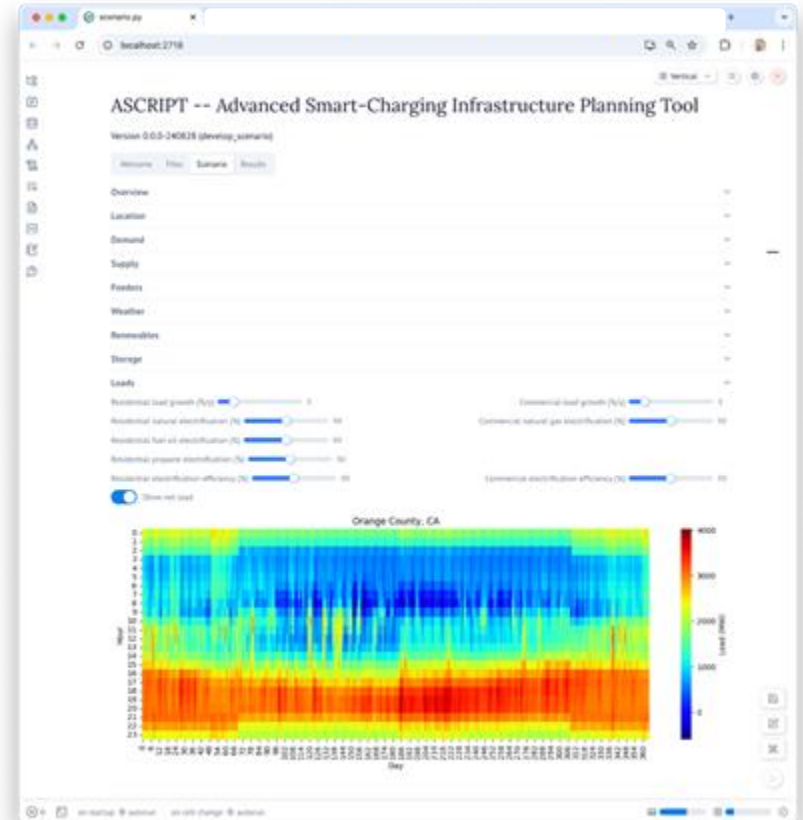


- Integrating CVX power flow solver in Arras Energy
 - This capability enables GridLAB-D to run optimal power flow solvers, to include various objectives (cost, emissions, etc), and constraints (limits on transformer, feeders etc).

Assess Impacts of Scenarios on Networks

Implement charging placement and dispatch solution in GridLAB-D

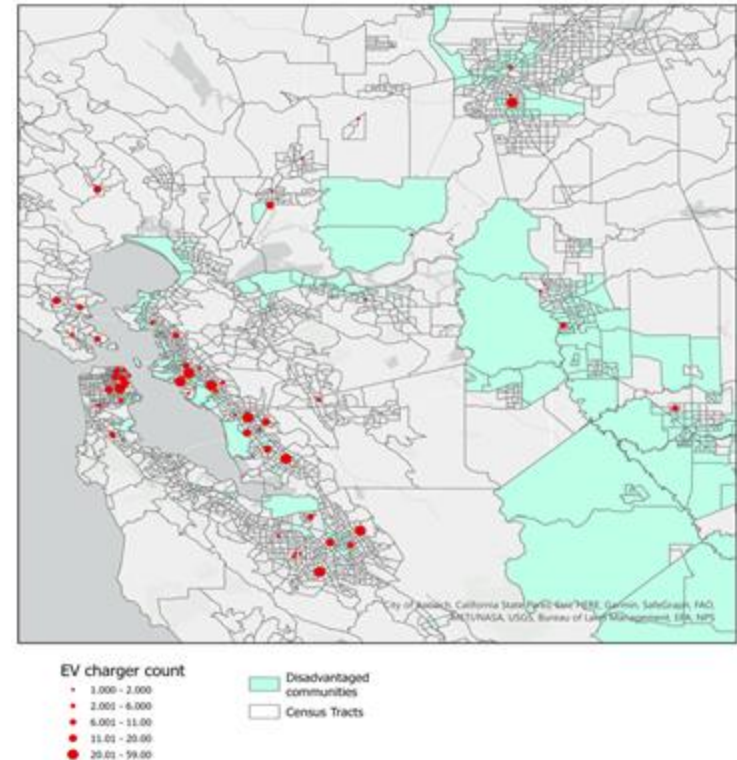
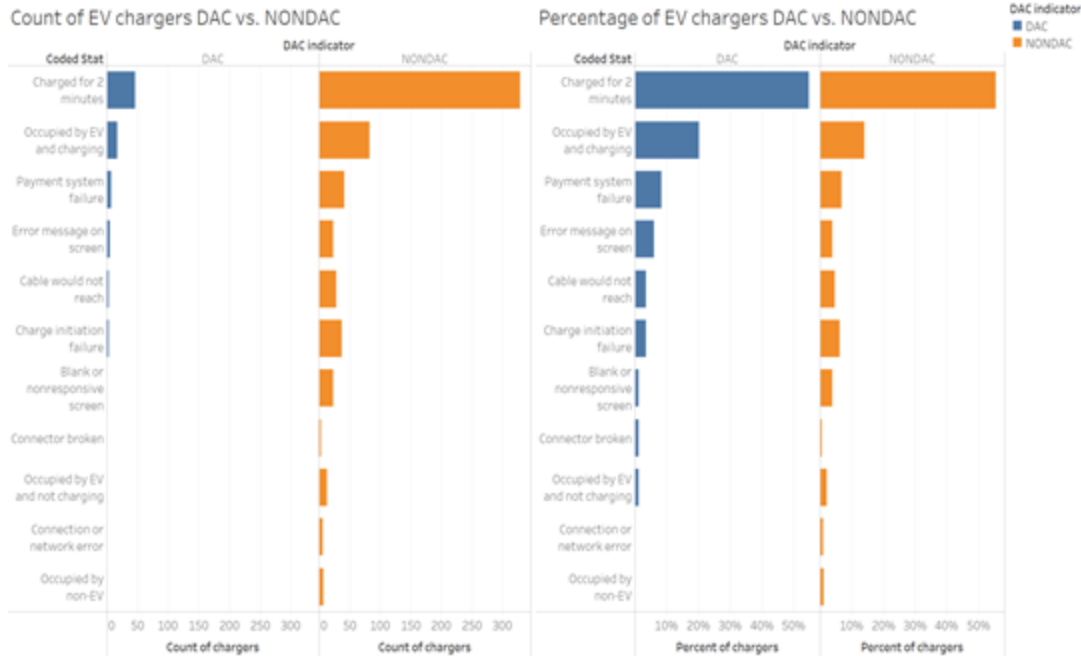
- Placement solution used to create GLM files of networks with EV chargers
- Dispatch solution run by GridLAB-D to study scenarios



Equity Analysis

Protocol to answer questions about:

- Common causes of EVSE malfunction
- Distribution of EVSE



User Integration/Experience Design (1)

SLAC

Application

ASCRPT_3.0

Advanced Smart Charging Infrastructure Planning Tool (ASCRPT)

ScenarioAnalysisTariffMapReport

Introduction

Our web-based app is designed to help you anticipate and manage the growing demand for electric vehicle (EV) charging. With controlled charging gaining traction, accurately estimating future charging loads across utilities, distribution, and transmission becomes crucial. Our tool allows you to input EV load estimates and other assumptions to compare and adjust control settings across different scenarios.

Creating a Scenario

Start by navigating to the **Charging Segments** section. Here, you can set the aggregation level to be the entire state or a specific county or city, and then tailor your scenario by selecting the region, targeted year, percentage or number of EV chargers, and rate structures. Additionally, you have the option to set constraints on **Feeder Capacity** and upload a list of assets for hotspot analysis within the network. For more detailed analysis, you can enable **Advanced Settings** to fine-tune the predicted **load shape** based on factors such as region, year, EV numbers, and rate schedules specified in Charging Segments.

Charging Segments

Aggregation level: County

Region: Santa Clara

Year: 2018

Number of EVs: 500,000

Number of EV chargers: 20,000

Specify the number of EV chargers either by:

- ☒ setting a ratio to the total number of chargers at each location
- ☐ specifying the exact number along with their types

Rate	Location	Ratio	Total	Level 1	Level 2	Level 3
TOU-R	Public	17 %	11205	8 %	88 %	28 %
All-Rate	Workplace	20 %	9150	8 %	180 %	8 %
E-TOU-C	Residential	33 %	10065	28 %	88 %	8 %

[Download](#)

Number of Chargers by Locations and Types

User Integration/Experience Design (2)

Charging Segments

Aggregation level:

Region:

Year:

Number of EVs:

Number of EV chargers:

Specify the number of EV chargers either by ☒ setting a ratio to the total number of chargers at each location

☐ specifying the exact number along with their types

Rate	Location	Ratio	Total	Level 1	Level 2	Level 3
<input type="text" value="100-R"/>	Public	<input type="text" value="17"/>	11285	<input type="text" value="0"/>	<input type="text" value="88"/>	<input type="text" value="28"/>
<input type="text" value="All Poly Phase"/>	Workplace	<input type="text" value="18"/>	9150	<input type="text" value="0"/>	<input type="text" value="180"/>	<input type="text" value="0"/>
<input type="text" value="E-TDU-C"/>	Residential	<input type="text" value="13"/>	10065	<input type="text" value="28"/>	<input type="text" value="88"/>	<input type="text" value="0"/>

Input options tailored for different user contexts

Number of Chargers by Locations and Types



Visualization of the number of EVs at different locations

User Integration/Experience Design (3)

Number of Chargers by Locations and Types



Feeder Capacity

Names (IDs):

Power constraint: MW

Peak load: %

Data Import:

Feeder	Substation	Service transformer	Meter ID	Building ID	Building type	Charging infrastructure	Coordinates
object	object	object	object	object	object	object	object
unique: 1	unique: 1	unique: 1	unique: 1	unique: 1	unique: 1	unique: 1	unique: 1
nullable: 0	nullable: 0	nullable: 0	nullable: 0	nullable: 0	nullable: 0	nullable: 0	nullable: 0

Thank you