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EVSE Deployment and Grid Evaluation (EDGE) Tool

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Overview

- Context
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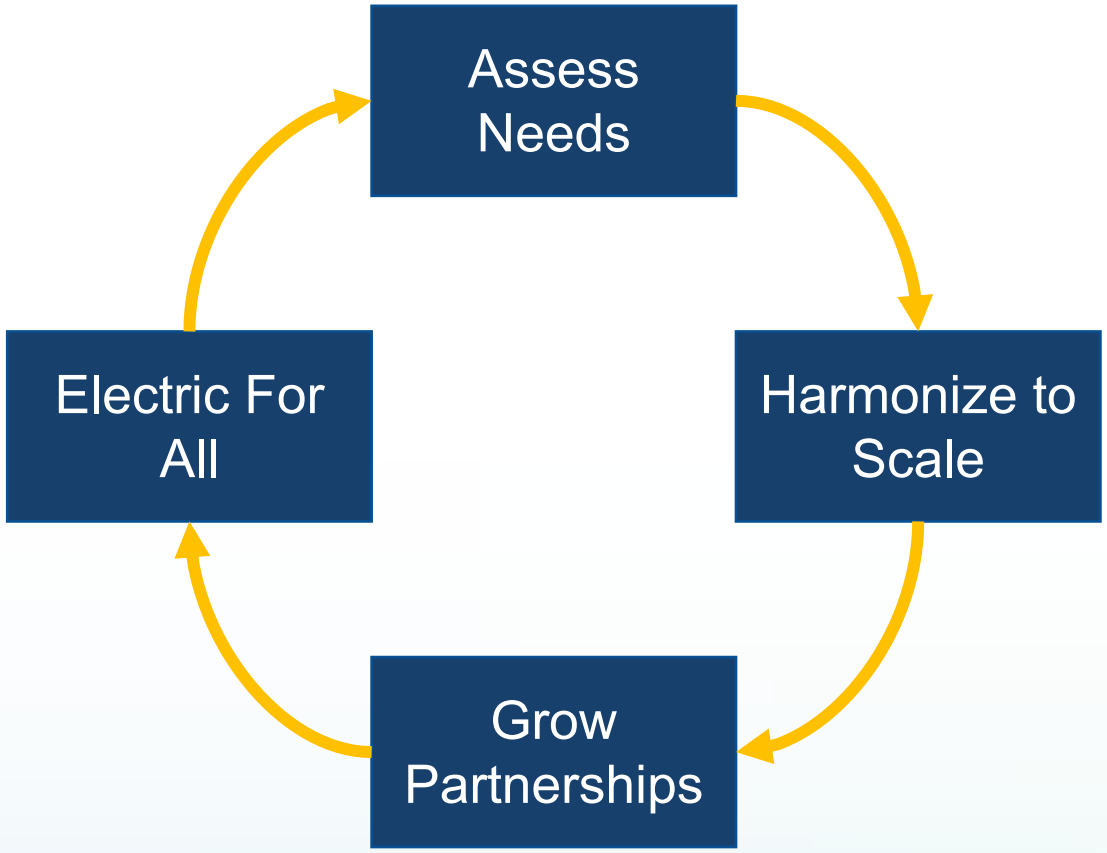
  - Objectives
- Design
  - Data Inputs
  - Model Framework
  - Geospatial Analysis
  - Capacity Allocation
- Concept for Metric: Equitable Smart Charging Factor
- Limitations

Background

Electric vehicles utilizing public charging ports

- **AB 2127** – assess infrastructure necessary to support 5 million ZEVs on CA roads by 2030
- **SB 1000** – assess disproportionality of EV charging infrastructure installations
- **Infrastructure quantification analyses** – number of chargers (by type and location) needed to support ZEV deployment goals

Objectives



Infrastructure Deployment Process Flow

- Analytical process flow - deploy sufficient infrastructure for all
- Tool to help users strategically target EVSE deployment and plan future infrastructure investments in order to:
  - Minimize/mitigate grid impact
  - Achieve air quality improvement targets
  - Meet EV travel demand in CA
  - Ensure equitable deployment
- EDGE domains
  - Grid impact
  - Air quality
  - Travel demand
  - Equity considerations

Data Inputs

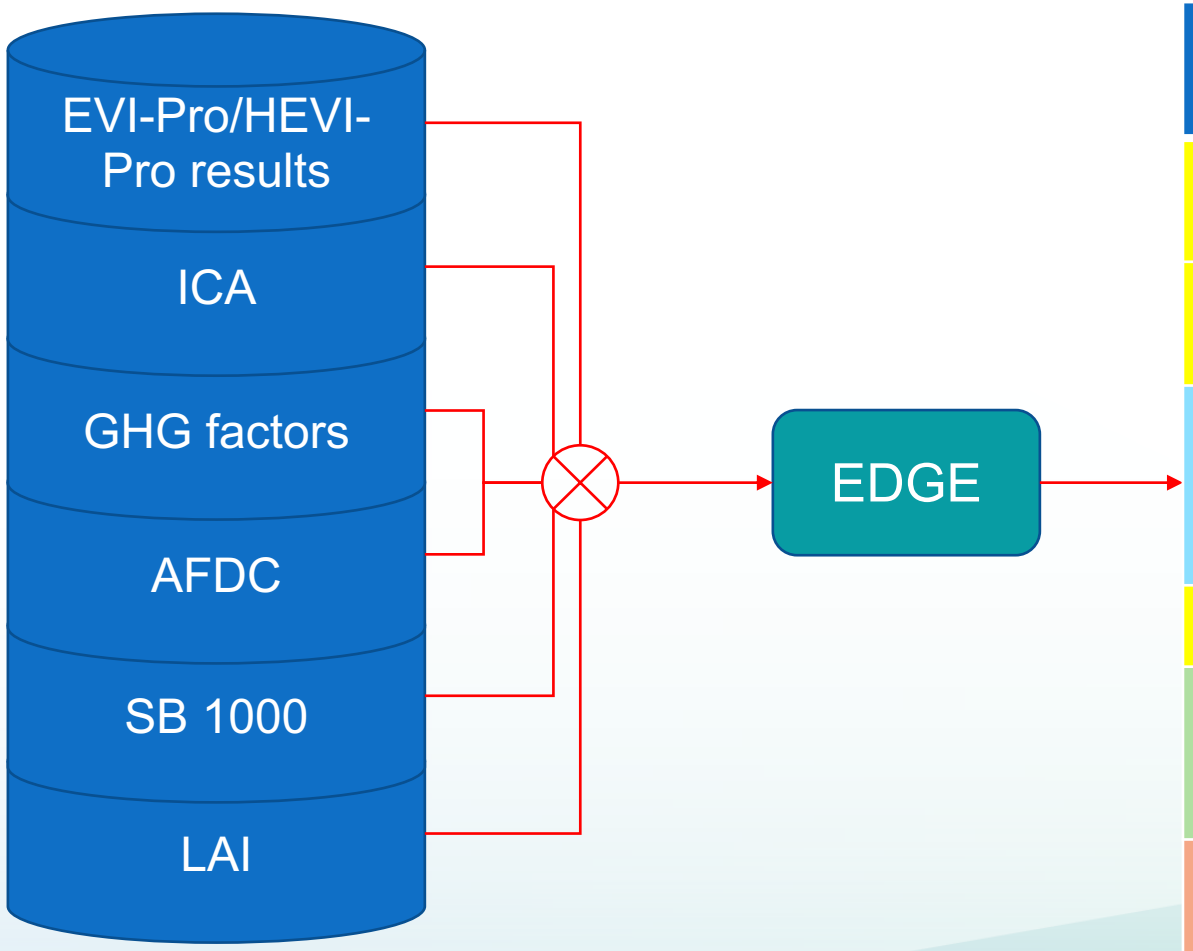
- EVI-Pro/HEVI-Pro quantification results
  - Used as the primary basis upon which other analyses are layered
- **G** – Grid impact
  - Integration Capacity Analysis (ICA) – regional distribution grid capacity
- **A** – Air quality
  - Energy Assessments Division GHG emissions factors
- **T** – Travel demand
  - Alternative Fuels Data Center (AFDC) – existing infrastructure environment
- **E** – Equity considerations
  - SB 1000 – disproportionality assessment/equitable accessibility
- Value of smart-charging solutions
  - Location Affordability Index (LAI)

Model Framework

Inputs

Processing

Output Domains



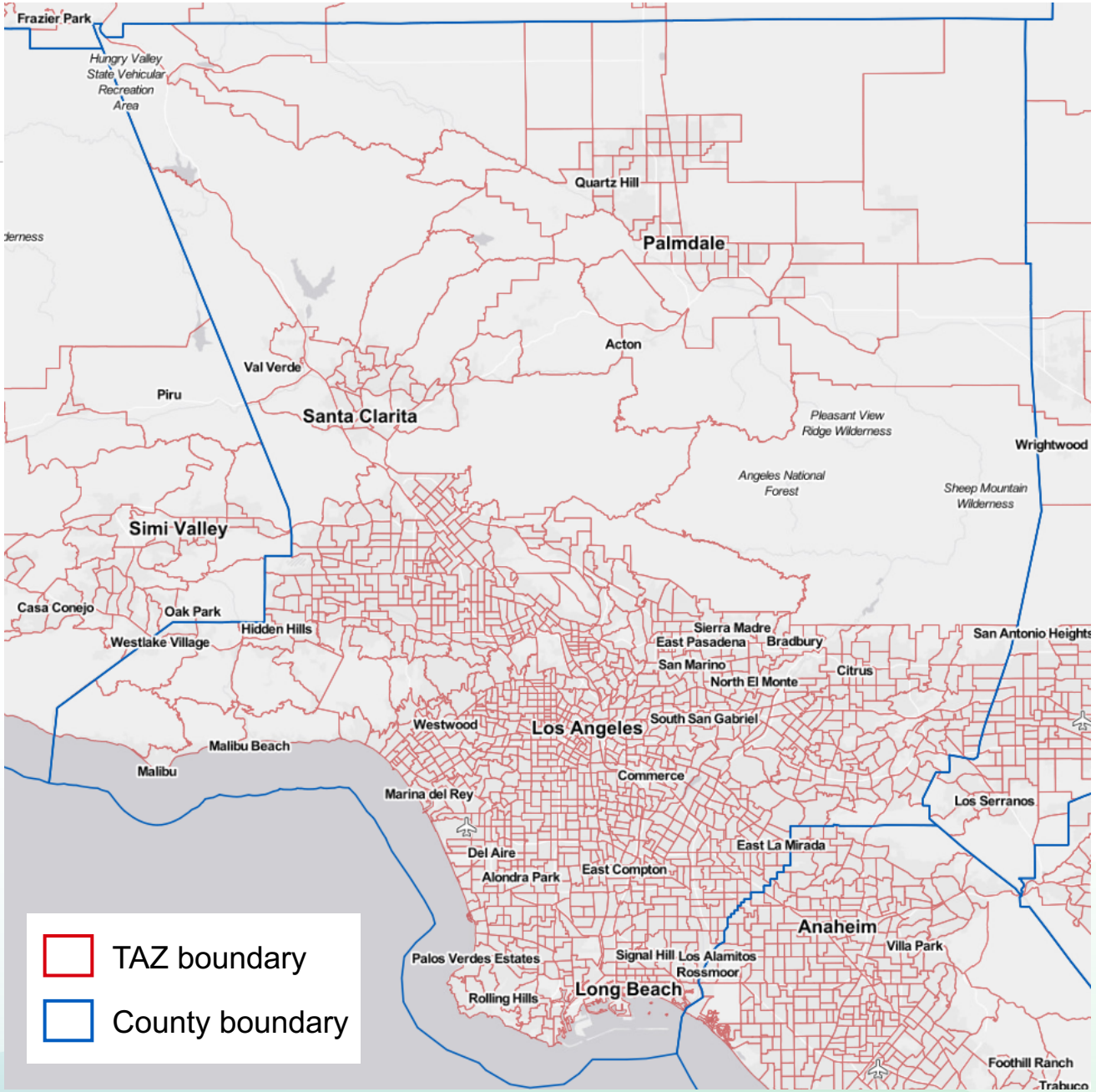
Spatial Unit	G – Grid	A – Air quality	T – Travel demand	E – Equity
Block Group	✓			✓
Census Tract		✓		✓
Traffic Analysis Zone (TAZ)			✓	
County	✓	✓	✓	✓
Air Quality Management District		✓		
Utility Territory	✓			

Defining a TAZ

- Shape/size constraints
  - Origin-destination (O-D) trip totals
  - Intra-zonal trip minimization
  - High statistical precision

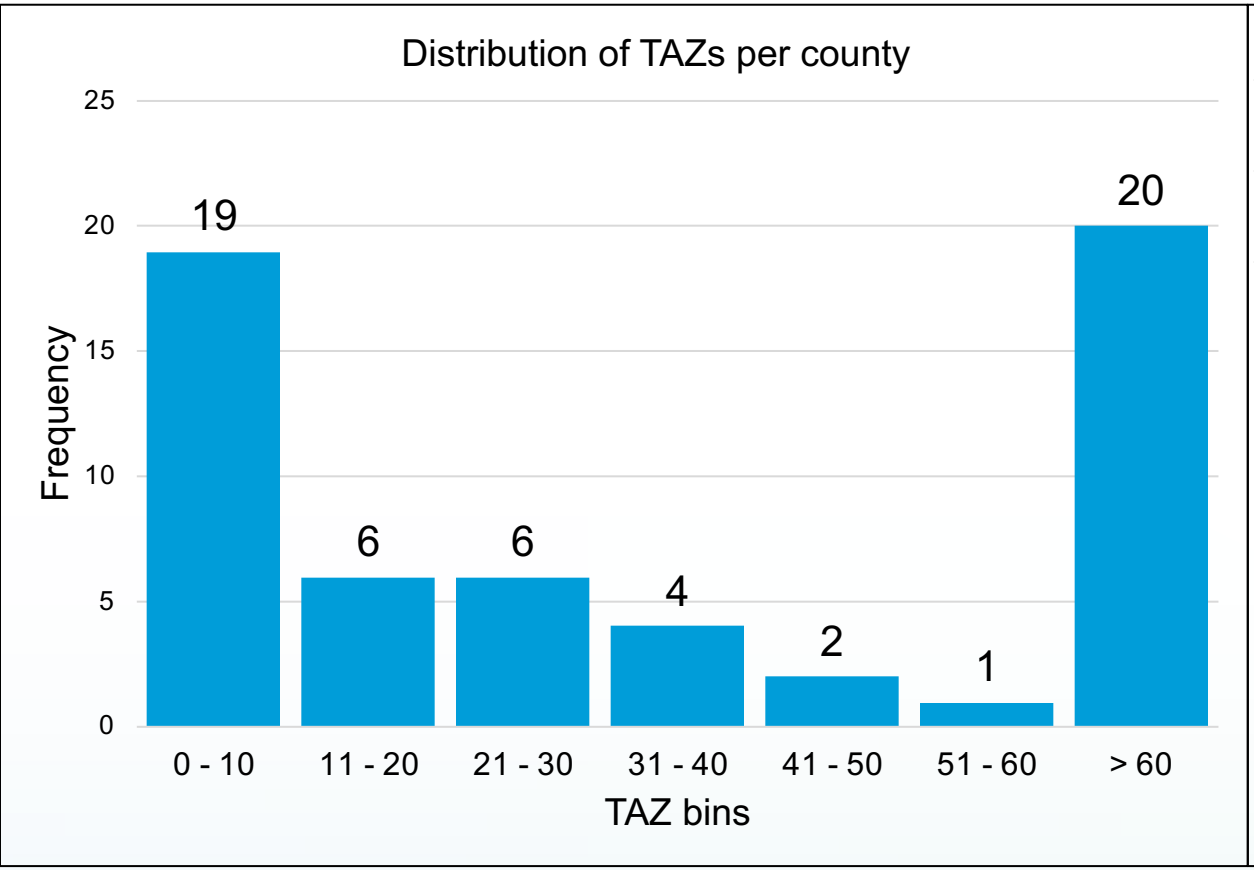
- Outcomes
  - Similar trip quantities across TAZs
  - Low relative statistical error
  - TAZ density proportional to O-D trip amounts

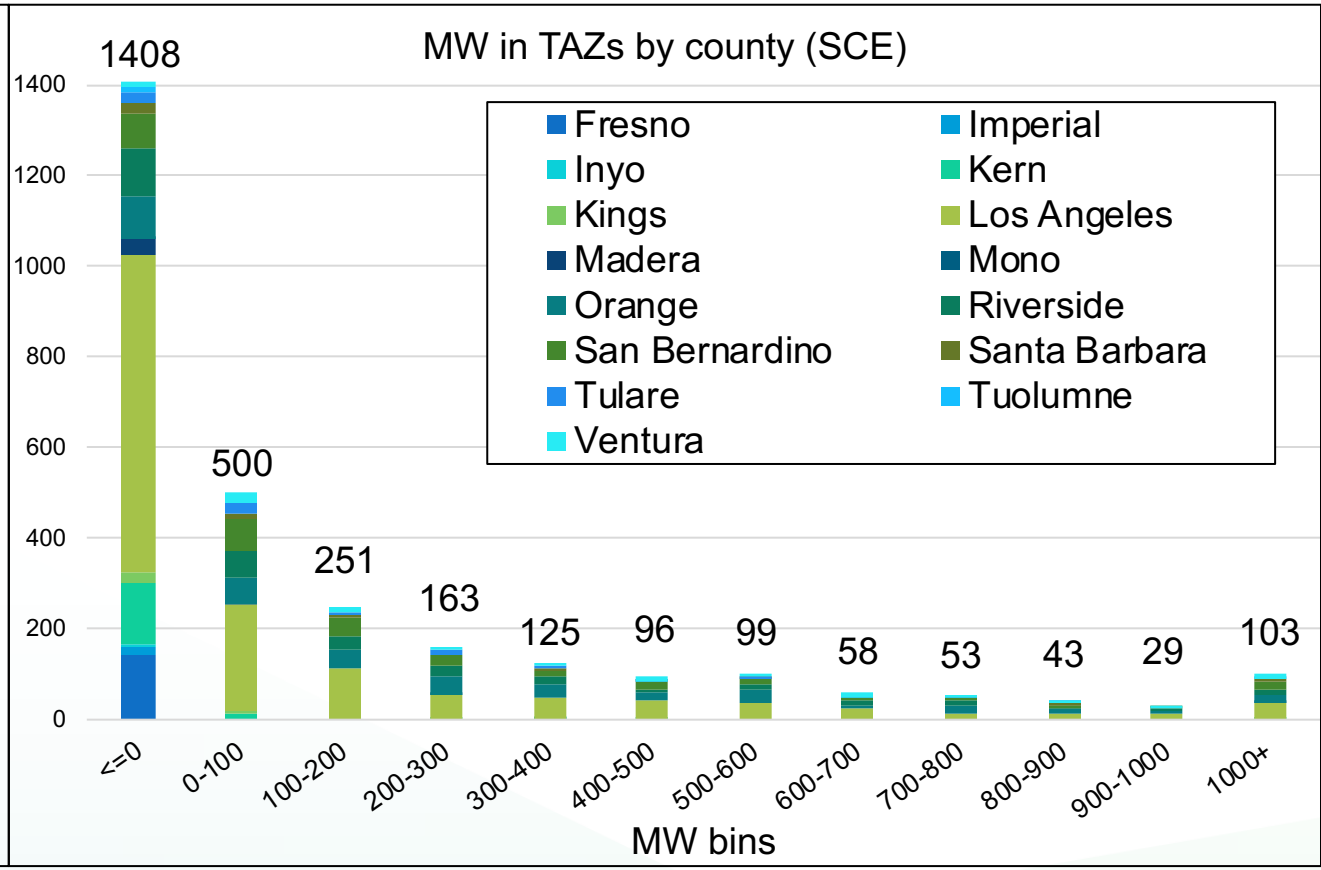
- EDGE: CA Statewide Travel Demand Model (CSTDM) data



Distribution of TAZs in LA County

Geospatial Analysis





- T domain – Number of TAZs in counties
- More TAZs → higher travel volume

- G+T domains – grid capacity in TAZs
- Preliminary view of existing capacity to host chargers

Capacity Allocation

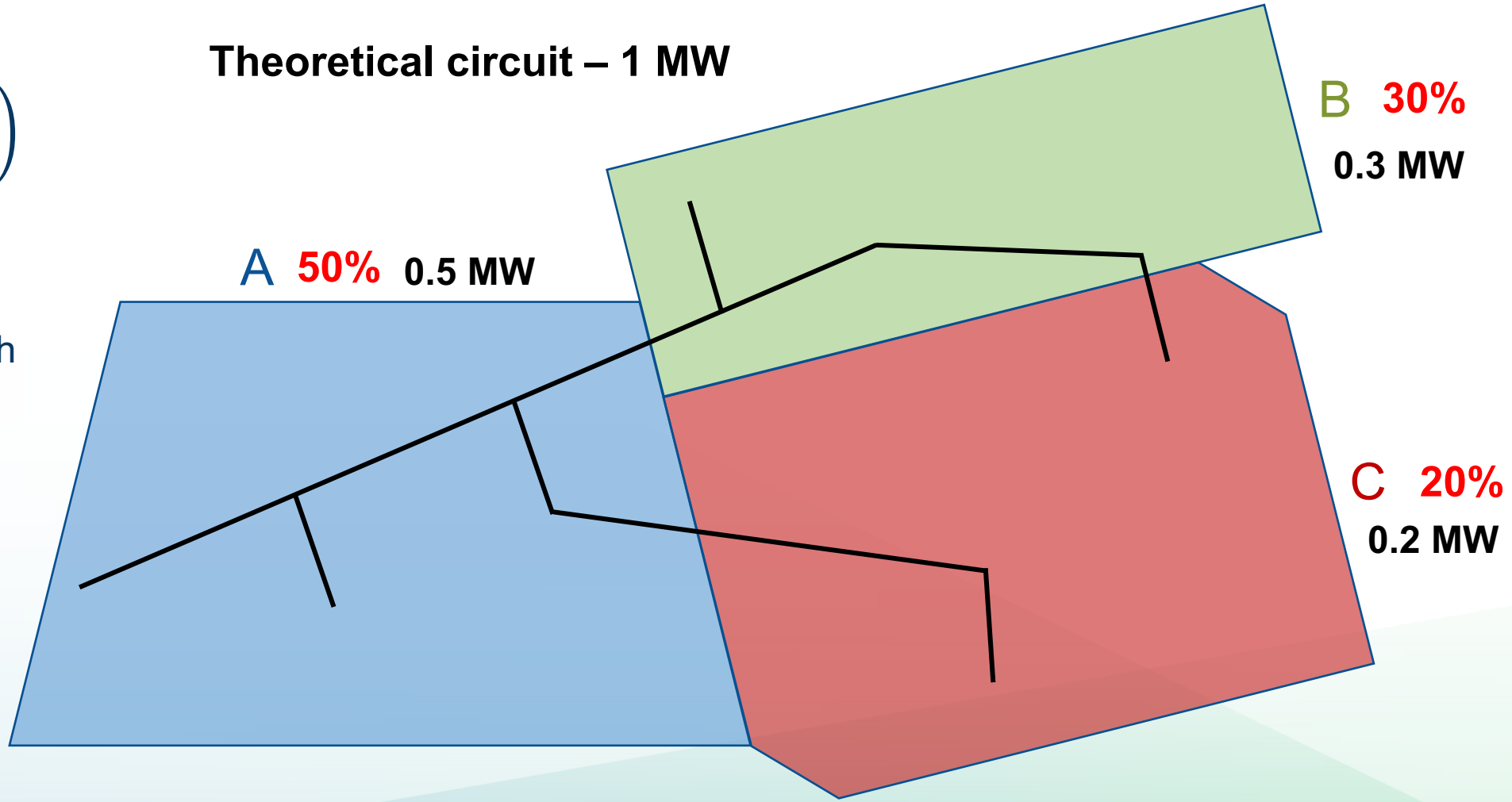
MW in a TAZ

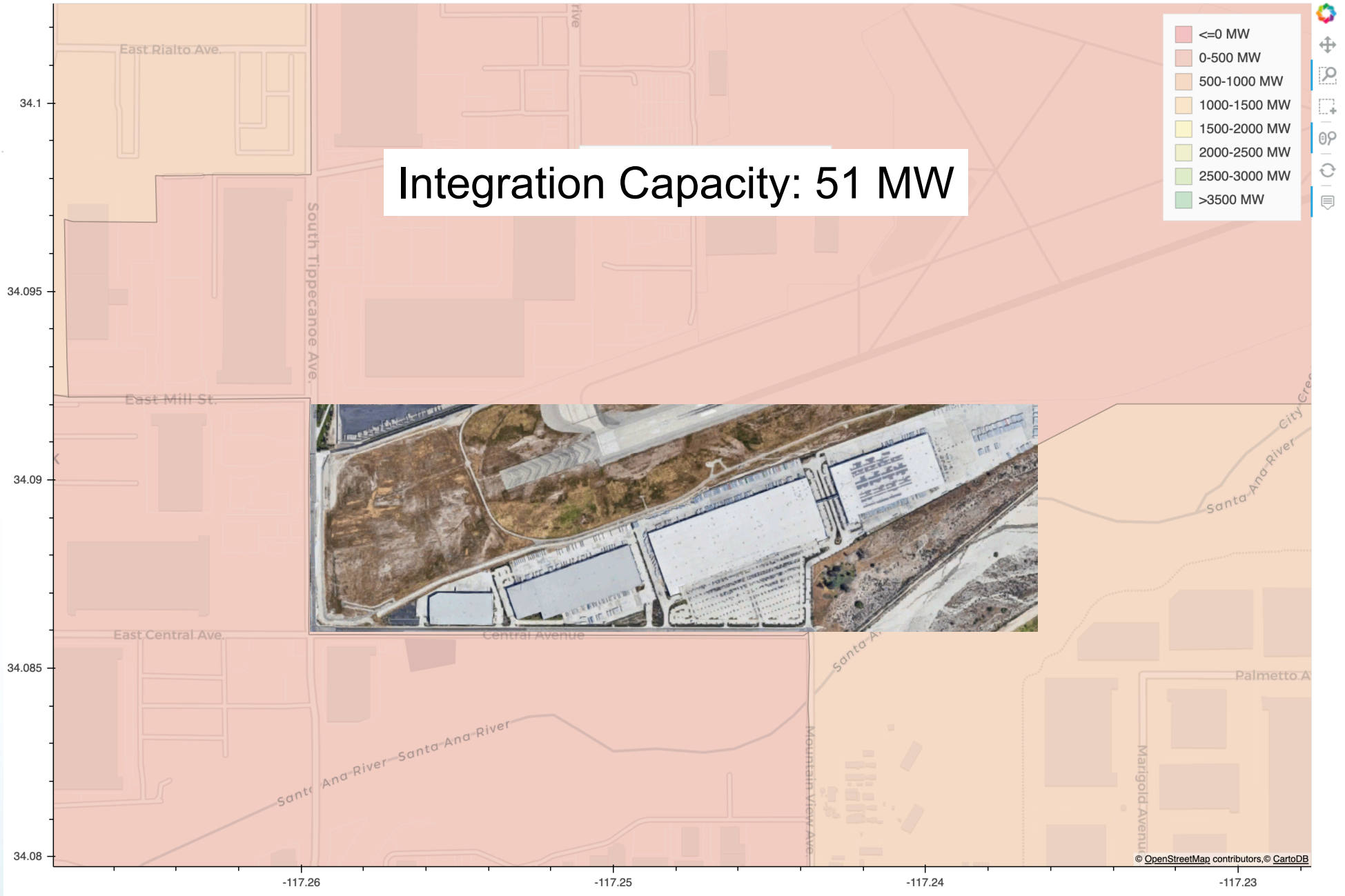
$$\sum_{i=1}^{n}\left(C_i * \frac{L_{C_i}}{L_{circuit}}\right)$$

Piecewise capacity

Length ratio

Theoretical circuit – 1 MW





EDGE Example: Distribution/Fulfillment Centers, San Bernardino

Illustration purposes only

Concept for Metric: Equitable Smart Charging Factor

ESCF = [(Vehicle and fuel costs) / (Household income)] * (Grid-negativity factor)

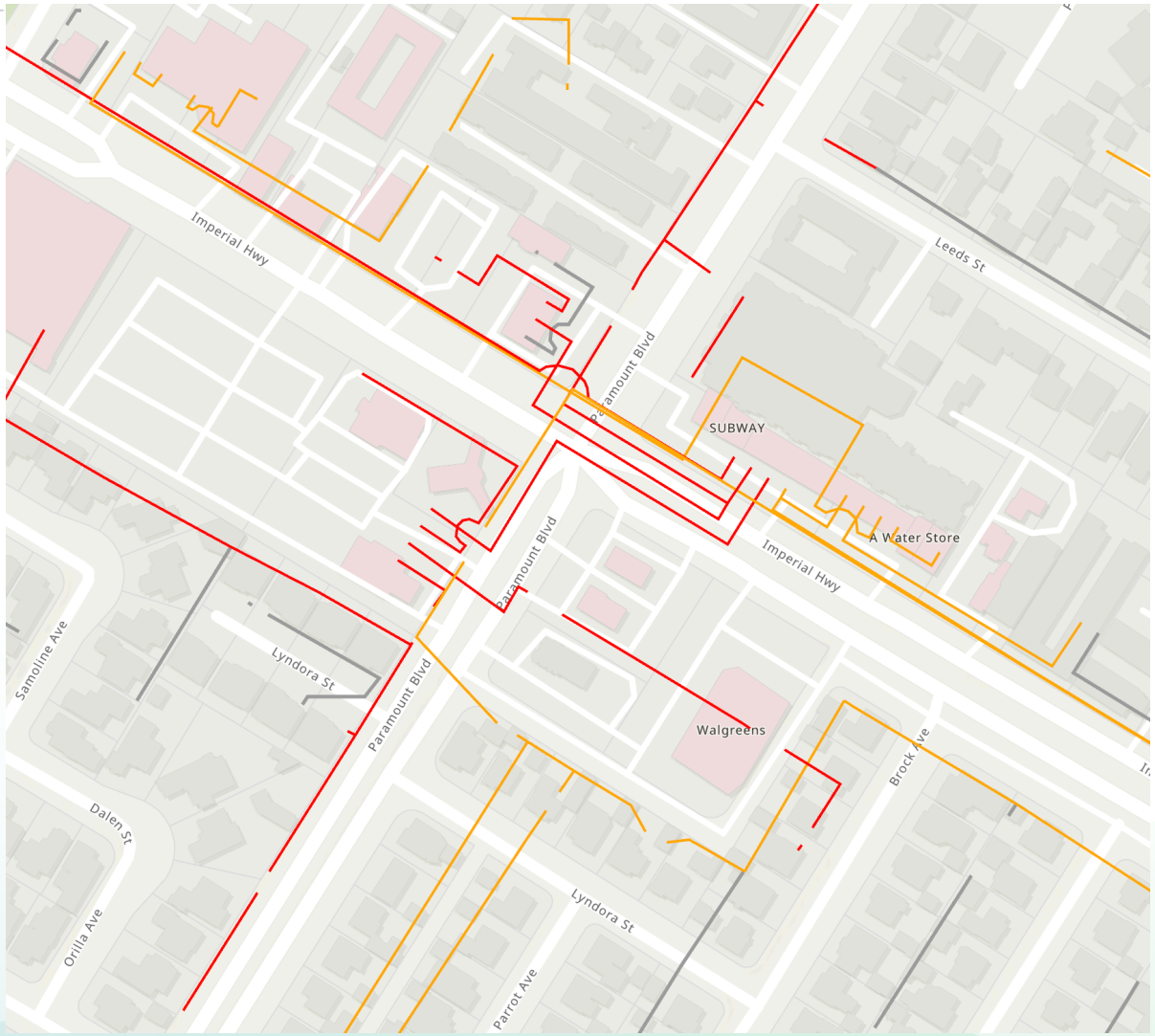
Location Affordability Index

Integration Capacity Analysis

- Theoretical approach
- Combines household auto ownership burden with regional grid constraints
- Complement to TERPA
  - Assess value of smart charging solutions in low-income communities
  - Target equitable VGI projects

Analytical Limitations

- Data integrity
  - Integration Capacity Analysis (ICA)
    - Spatial discontinuities
    - Validation framework
  - Location Affordability Index – dated info
    - Longitudinal Employer-Household Dynamics (LEHD) [2014]
    - Vehicle Miles Traveled (VMT) [2013-2015]
    - American Community Survey (ACS) [2016, 5-year period]
- Data acquisition
- Algorithm design



Screen capture of SCE ICA map

Stakeholder Feedback

To continue EDGE development, we welcome stakeholder input:

- Additional data sources?
  - Travel volumes between origins and destinations
  - Grid capacity estimation and validation
- How to improve allocation algorithms?
- Use cases in the queue:
  - Smart charging
  - Air quality attainment
  - Carbon emissions intensity
  - Equitable deployment of infrastructure
- User interfaces – what features would be most user friendly?
- How to work with utilities to
  - Ensure data access and accuracy?
  - Secure the grid infrastructure data?

Thank You!

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Concept for Metric: Equitable Smart Charging Factor

APPENDIX

$$ESCF = \left[A * \left(V_{sf} + V_{fc} + V_{fixed}\right) + \left(\frac{VMT}{MPG}\right) * \mathrm{G} * (1 + \mathrm{R})\right] * \frac{1}{Y} * \frac{\left|max\left(MW_{grid}, MW_{CD}\right)\right|}{N}$$

Vehicle-associated costs

Fuel cost

Income

Overall auto ownership burden

Grid negativity factor

- A = modeled vehicles per household
- V_{sf} = vehicle service flow cost
- V_{fc} = vehicle finance charges
- V_{fixed} = vehicle fixed ownership cost
- VMT = household vehicle miles traveled
- MPG = average miles per gallon
- G = average annual $/gal gasoline
- R = average drivability to fuel cost ratio
- Y = household income
- MW_{grid} = areal grid capacity (lower bound)
- MW_{CD} = locational charging demand (upper bound)
- N = normalization coefficient (# households per census tract)