



SB 1014 Clean Miles Standard Business-As-Usual Inventory Workshop

April 1, 2020

Sacramento, CA

Purpose of Workshop

- Establish business-as-usual emissions inventory
- Discuss method, data sources and assumptions
- Present preliminary results
- Solicit feedback

Note: The data analysis and results presented here are preliminary.

Outline

- Introduction to SB 1014
- Purpose of Emissions Inventory
- Methodology
- Parameters & Assumptions
- Preliminary Inventory Results
- Next Steps

Background



The transportation sector accounts for almost 50 percent of GHG emissions in California with light-duty making up 70 percent of the transportation sector's direct emissions.



SB 1014 requires CARB and CPUC to adopt and implement a program to reduce GHG emissions from transportation network companies.



The new regulation will encourage zero-emission vehicles and VMT reduction strategies, and account for automated vehicles in TNCs.

Principles for Developing the New Regulation

Regulation Design

- Decrease GHG emissions and increase zero-emission miles
- Promote pooling, active transport, and transit usage
- Forward-looking with automated vehicles
- Aligned with other State policies
- Maximize transportation access equity

Development Process

- A synergistic process
- Data-driven
- Encourage ZEV infrastructure
- Minimize burden to low- and moderate-income drivers

Emissions Inventory

- SB 1014 requires CARB to establish GHG emissions on a per passenger mile travelled (PMT) basis.
- Business-As-Usual (BAU) Inventory - forecasted TNC activity and associated emissions without the regulation
- Regulation Inventory - forecasted TNC activity and associated emissions with the regulation
 - Used in the regulatory development process
- Models developed for these calculations

Recap 2018 Base-Year Inventory **Methodology**

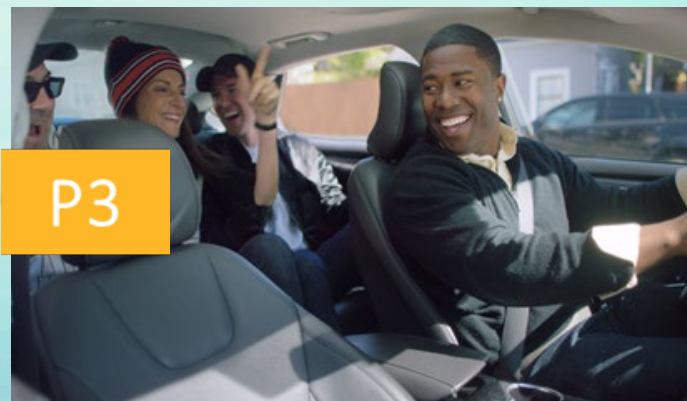
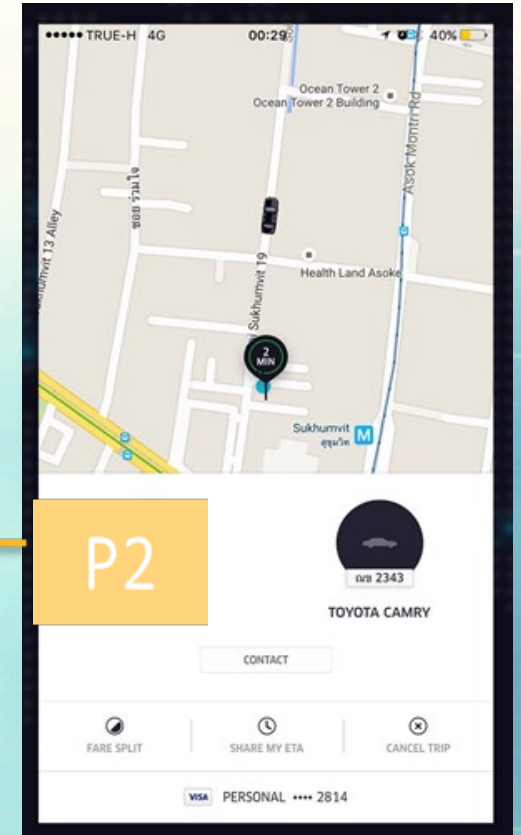
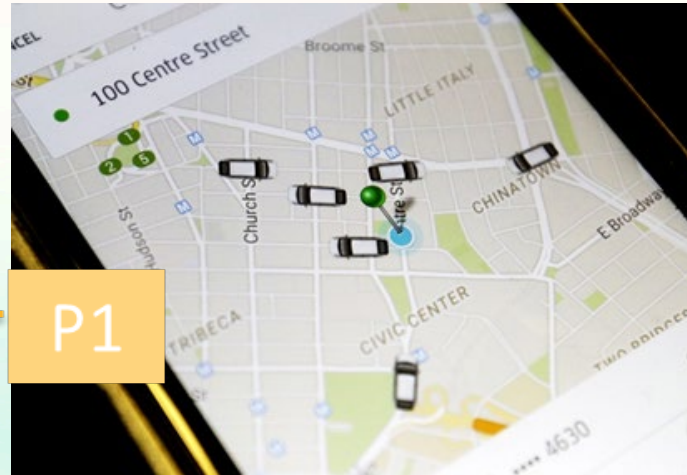
Periods Defined for TNC Miles

Period 0 (not captured in rule)
Work session not started

Period 1
Driver looking for riders

Period 2
Driver en route to riders

Period 3
Rider(s) in vehicle



2018 Base-Year TNC Inventory

- More information on the base-year inventory data can be found here, <https://ww2.arb.ca.gov/resources/documents/2018-base-year-emissions-inventory-report>
- Developed with 2018 TNC data
- Deduped to remove duplicate miles
- Speed corrected vehicle-specific fuel economy to reflect real-world TNC driving

Base-Year gCO₂/PMT Calculation

$$\frac{\text{Grams CO}_2}{\text{PMT}} = \frac{\text{VMT (miles)} \times \text{Real World Fuel Consumption (gal/mi)} \times \text{Conversion (gCO}_2\text{/gal)}}{\text{Ride VMT (miles)} \times \text{Occupancy} + \text{Active/Transit PMT}}$$

VMT in periods 1, 2, & 3 (points to VMT (miles))

Fuel Dependent (points to Real World Fuel Consumption (gal/mi))

Only period 3 VMT (points to Ride VMT (miles))

Does not include driver (points to Occupancy)

Assumed to be zero (points to Active/Transit PMT)

Business-As-Usual (BAU) Inventory **Methodology**

Business-As-Usual (BAU) Inventory

- Business-As-Usual (BAU) Inventory - forecasted TNC activity and associated emissions without the regulation
- Start with 2018 base year inventory, including total VMT and trip counts by starting zip code for each vehicle
 - Zip code assigned to geographical area
 - Vehicle assigned to EMFAC vehicle class, model year and fuel type
 - Correct EMFAC CO₂ emission factors to account for differences between TNC and CA fleet average in speed and technology

BAU gCO₂/PMT Calculation

VMT in periods 1, 2, & 3
= P3 VMT / (1 - deadheading ratio)

CO₂ emission rates specific to GAI,
calendar year, vehicle class, fuel type,
technology, speed, and model year

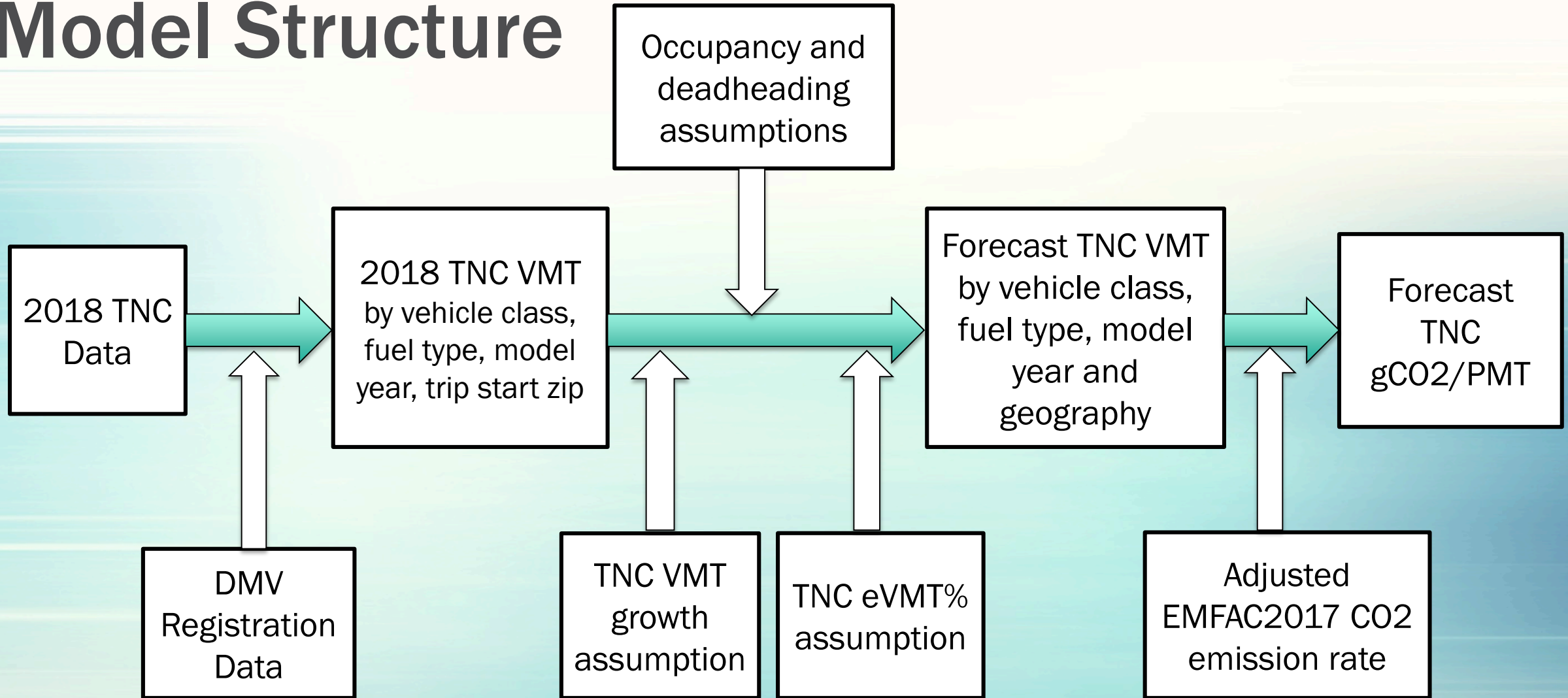
$$\frac{\text{Grams CO}_2}{\text{PMT}} = \frac{\sum (\text{VMT (miles)} \times \text{Adjusted CO}_2 \text{ Emission Rate (g/mile)})}{\sum (\text{P3 VMT (miles)} \times \text{Occupancy} + \text{Active/Transit PMT})}$$

Forecasted using growth
assumption

Does not include driver

Assumed to be zero

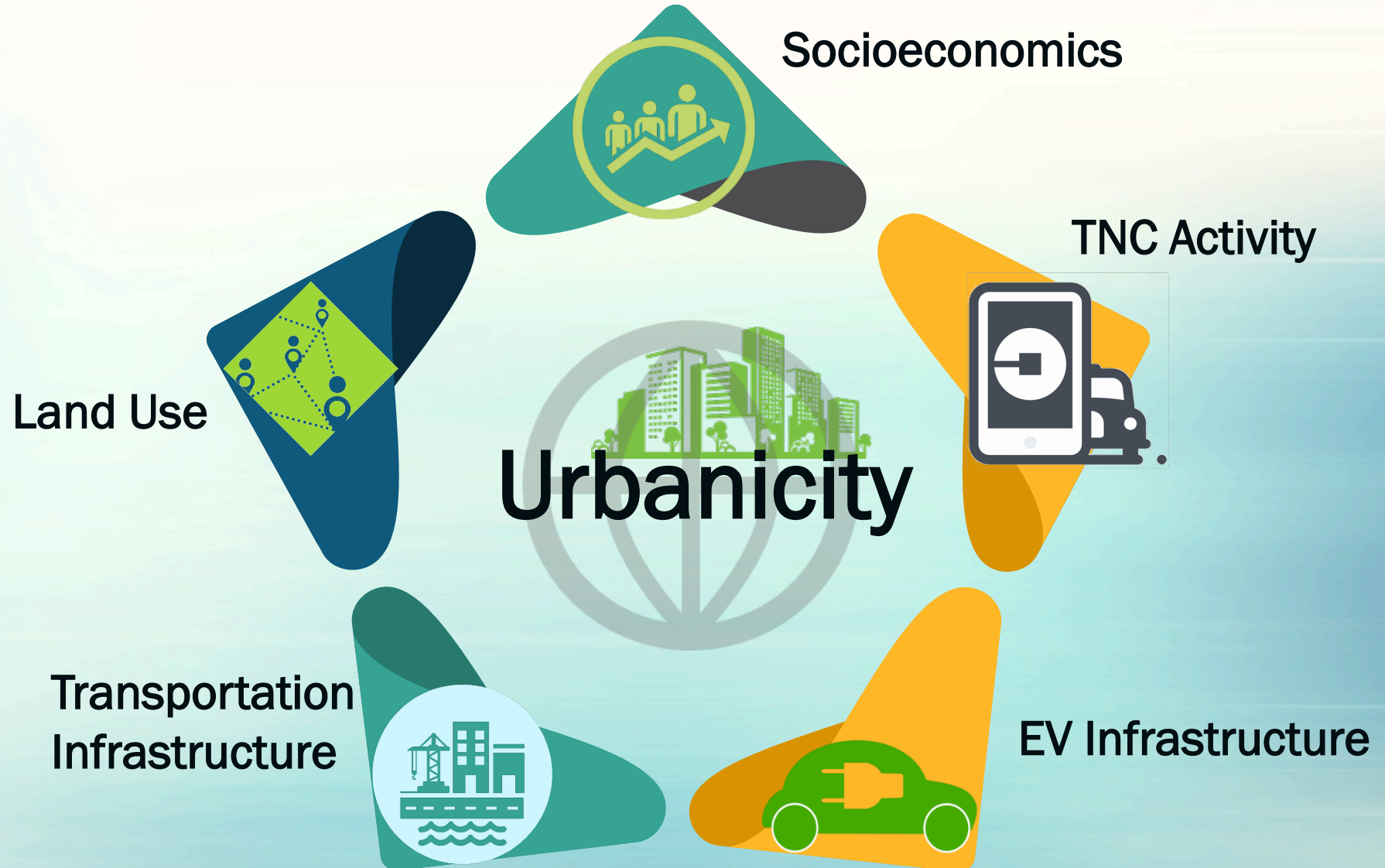
Model Structure



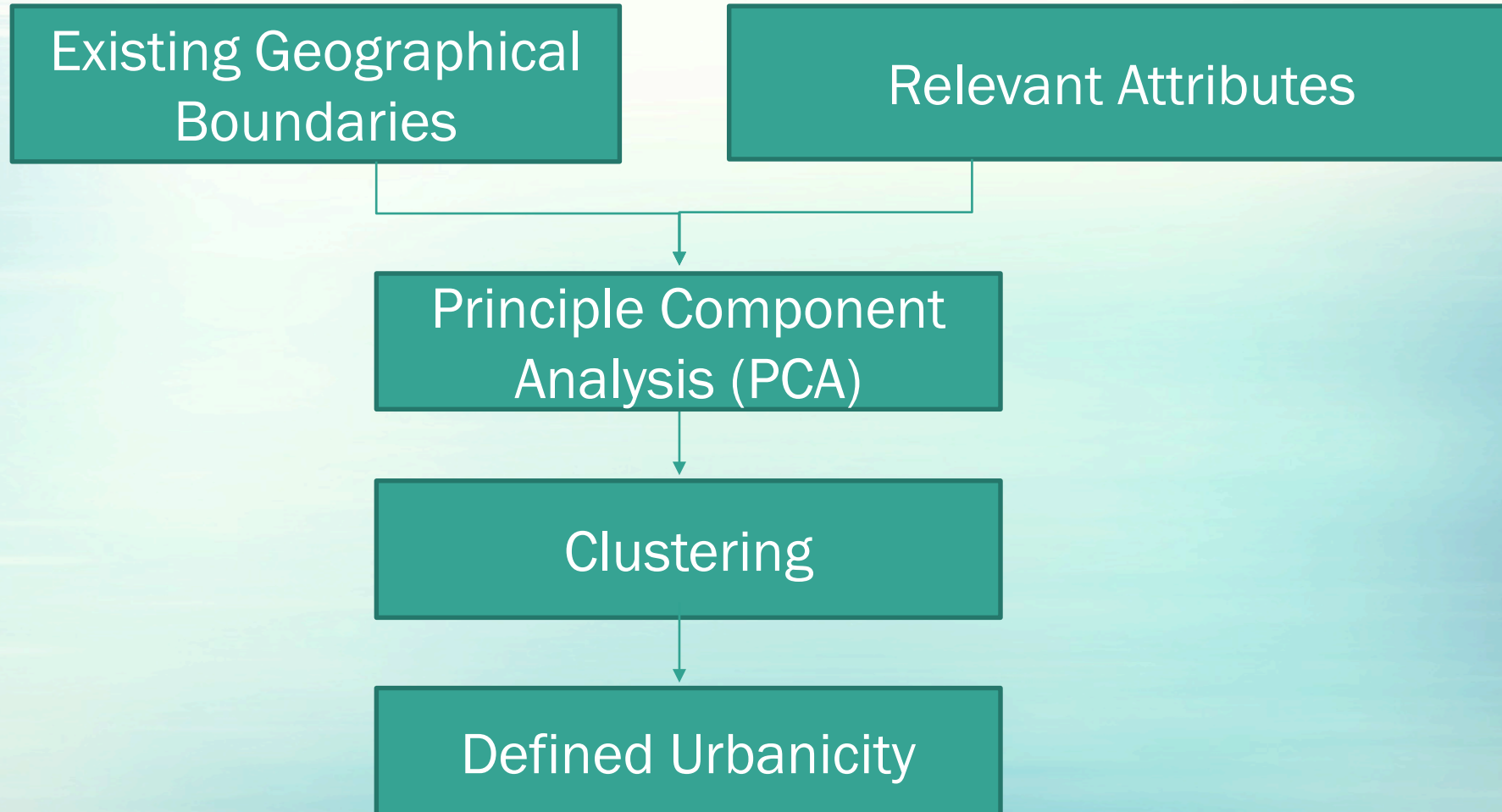
Urbanicity

- Urbanicity is a geographical classification of land use as a way to distinguish the magnitude and type of potential TNC activity.
 - Classifications are based on *relevant attributes*
- Provides geographical basis for input assumptions (e.g. TNC growth) and regulation strategy assumptions (e.g. electrification, pooling, etc.).

Relevant Attribute Categories



Urbanicity Methodological Framework



Existing Geographical Boundaries

COARSE

FINE

107 Sub-areas

1,769 zip code tabulation areas

5,454 Traffic Analysis Zones

8,057 Tracts

Legend
State Boundary
CoAbDis

Legend
State Boundary
ZIP Code Tabulation Areas

Legend
State Boundary
CSTDM_v2.0_TAZ

Legend
State Boundary
Census Tracts

0 25 50 100 150 200 Miles

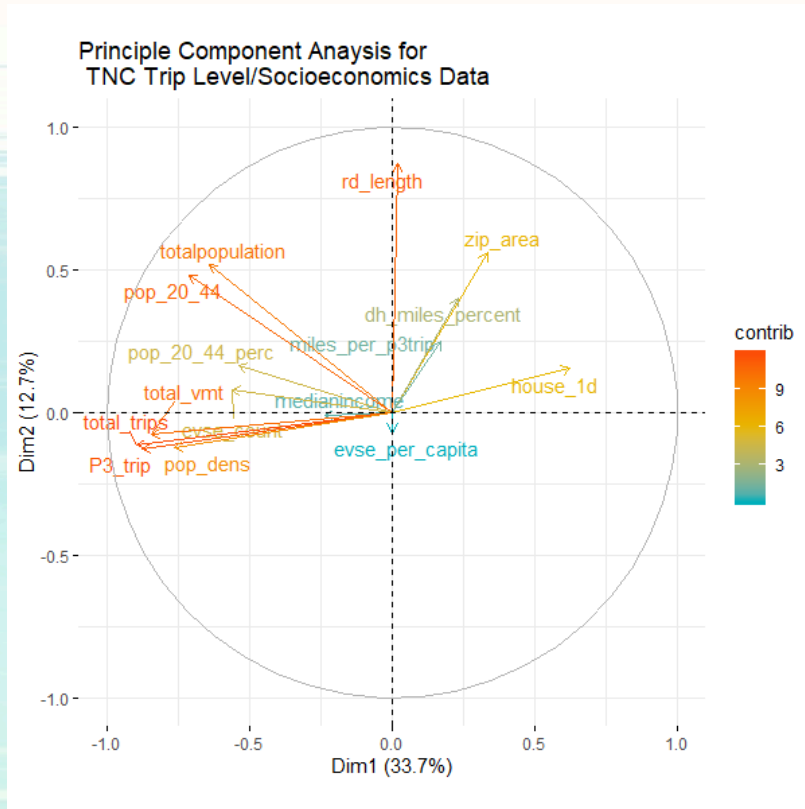
COABDIS

Zip Codes

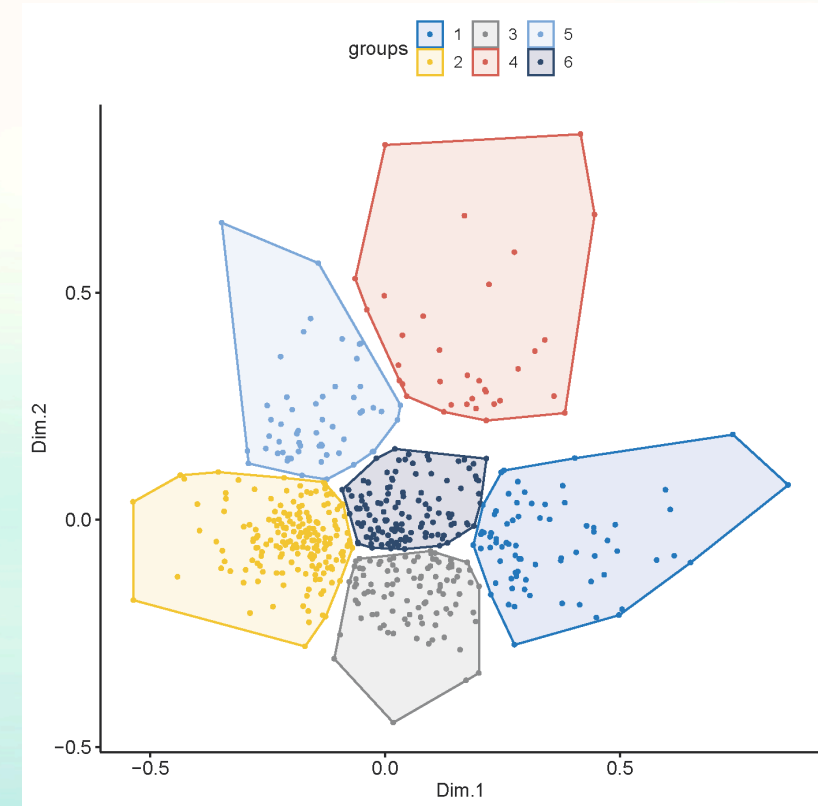
CSTDM 2.0 TAZs

Census Tracts

PCA and Clustering



PCA removes correlations among the attributes which results in principal components.



K-means Clustering assigns the geography into pre-defined number of clusters.

Urbanicity Classifications

Urban Core

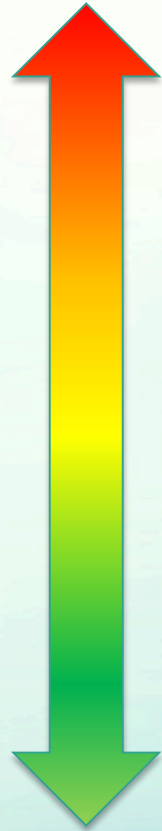
Urban

Urban Skirt

Suburban

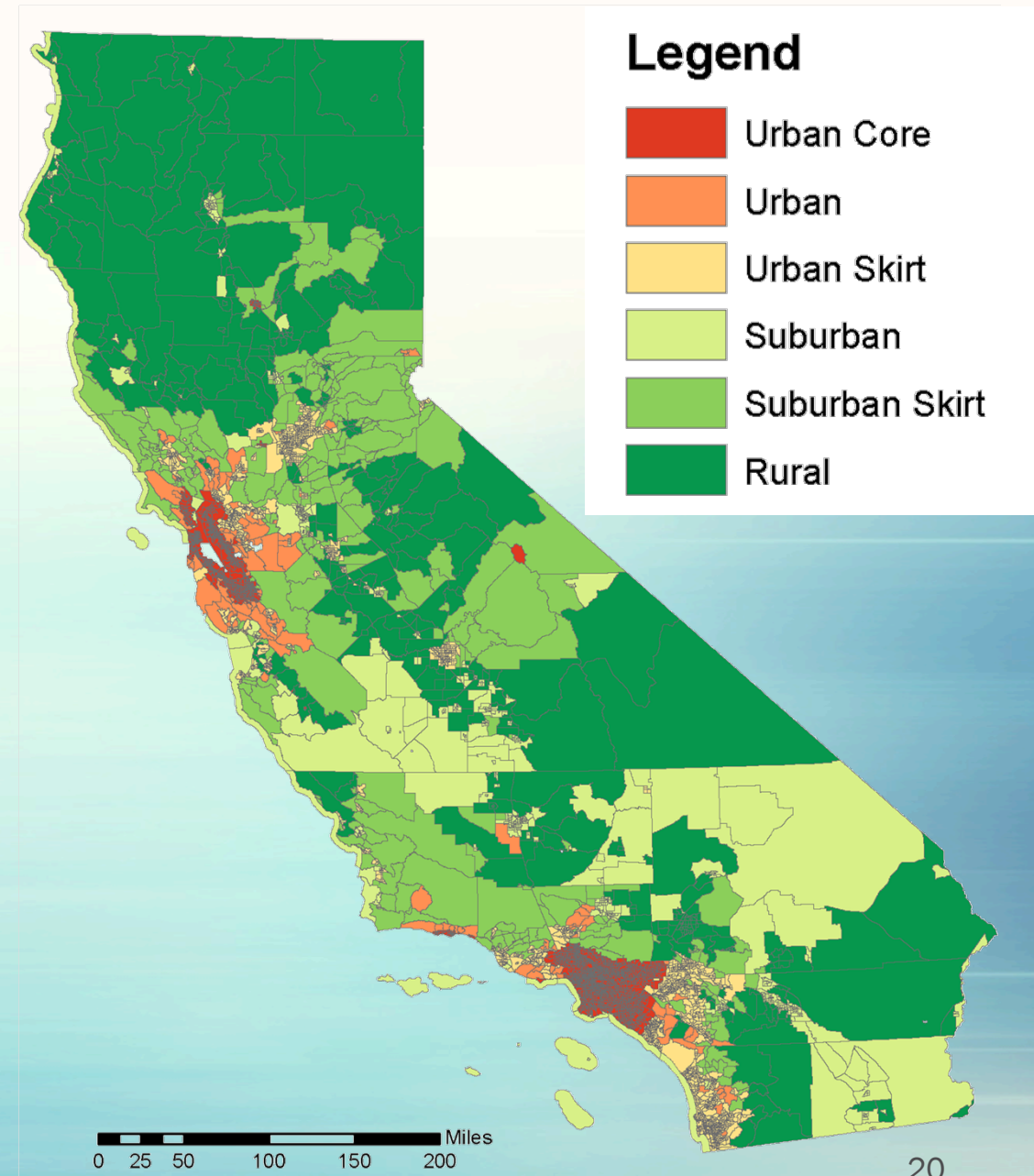
Suburban Skirt

Rural



*Higher Propensity
for TNC Activity*

*Lower Propensity
for TNC Activity*



Legend

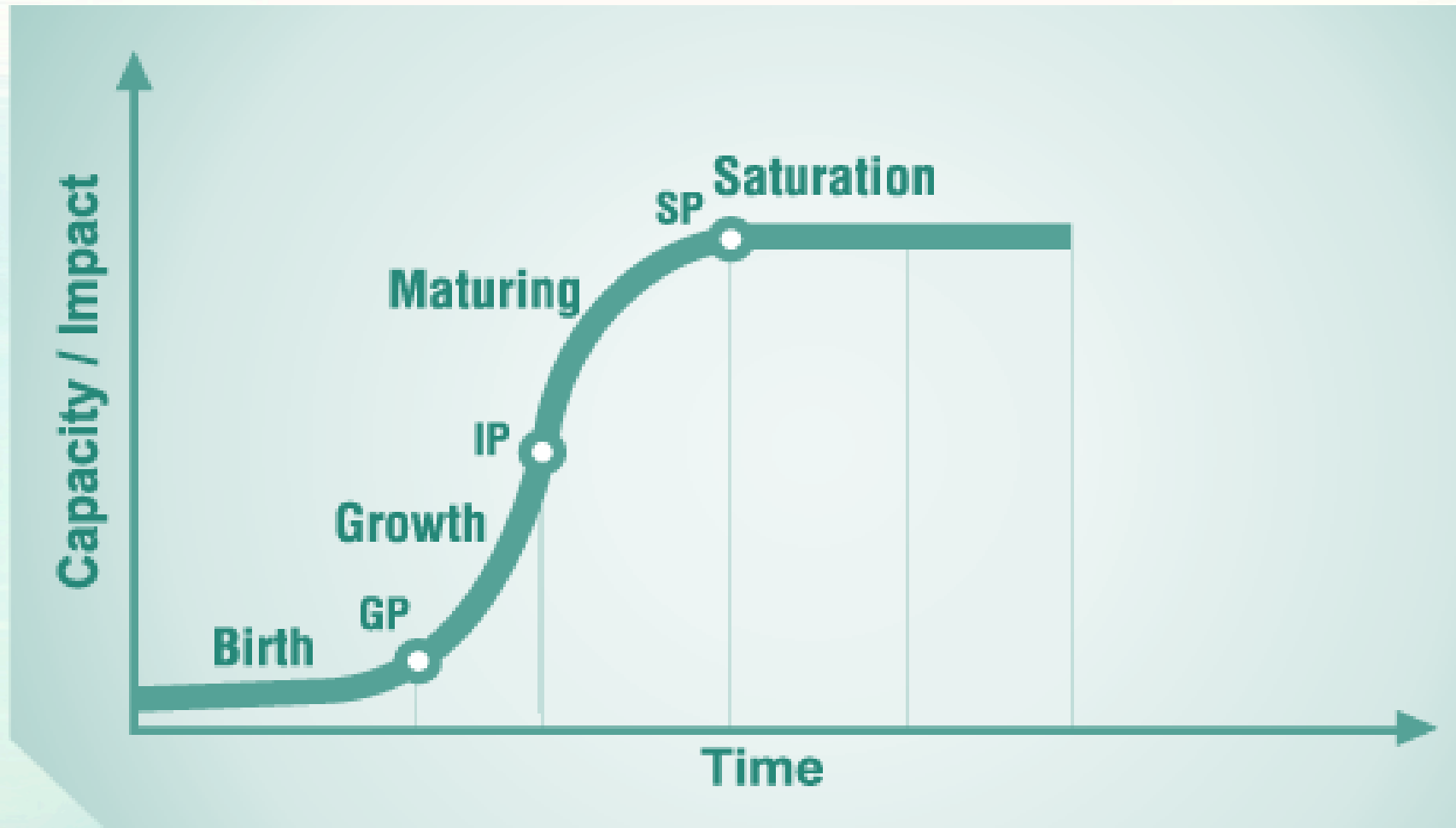
- Urban Core
- Urban
- Urban Skirt
- Suburban
- Suburban Skirt
- Rural

Model Parameters & Assumptions

Model Parameters

- TNC growth
- Occupancy
- Deadheading
- eVMT%
- ZEV technology mix
- Fleet mix (age, vehicle class)
- CO2 Emission Rates and TNC Correction Factor

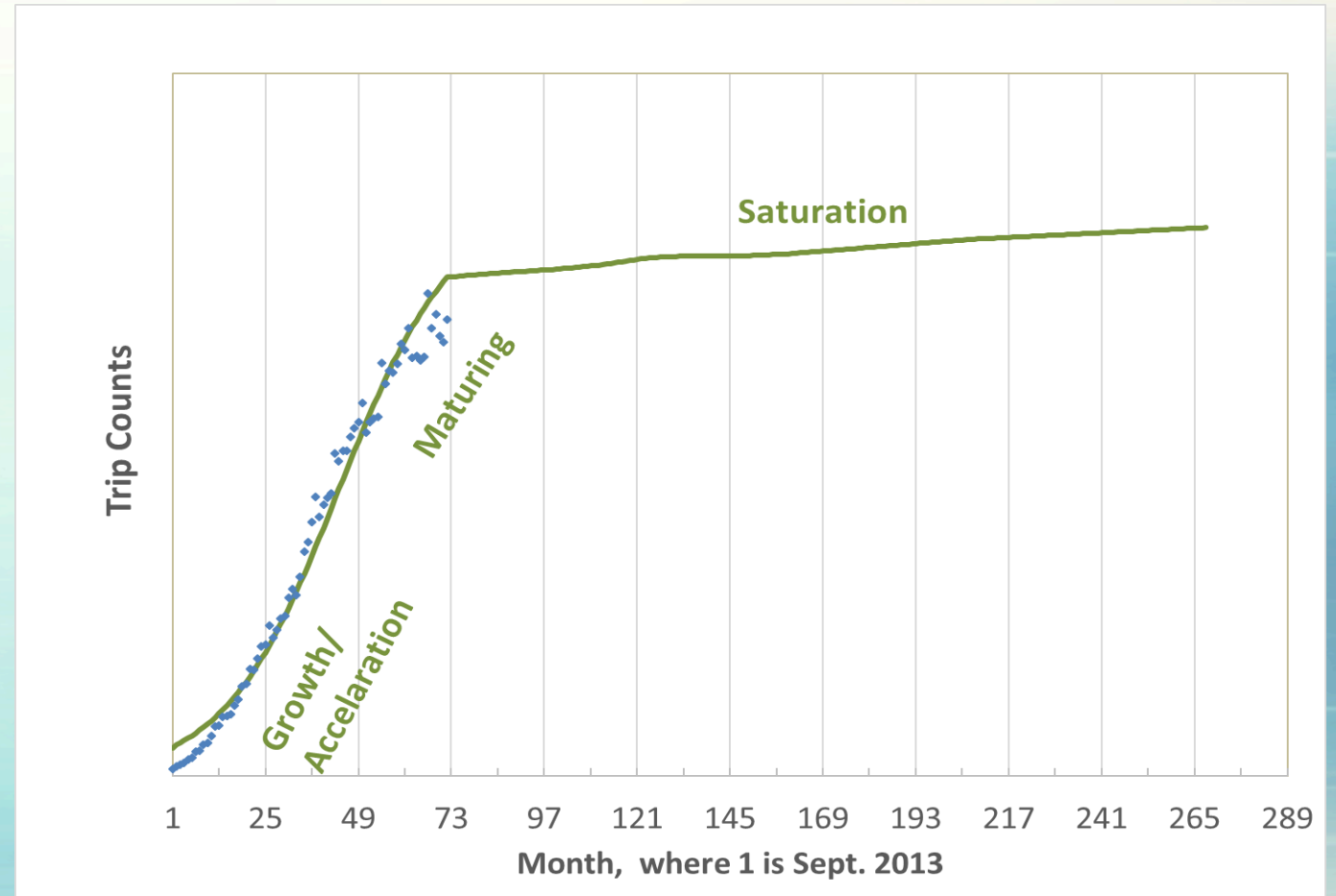
What should TNC growth look like?



Proposed Approach

s-curve based on historical TNC data

- Major metro areas in CA already experiencing slowing growth
- Historical TNC data from CPUC used to assess growth/accel.
- Beyond saturation point, growth would be proportional to population or MPO VMT growth
- Future refinements may include varying growth by urbanicity



Occupancy

$$\frac{\text{Grams CO}_2}{\text{PMT}} = \frac{\Sigma (\text{VMT (miles)} \times \text{Adjusted CO}_2 \text{ Emission Rate (g/mile)})}{\Sigma (\text{P3 VMT (miles)} \times \text{Occupancy} + \text{Active/Transit PMT})}$$

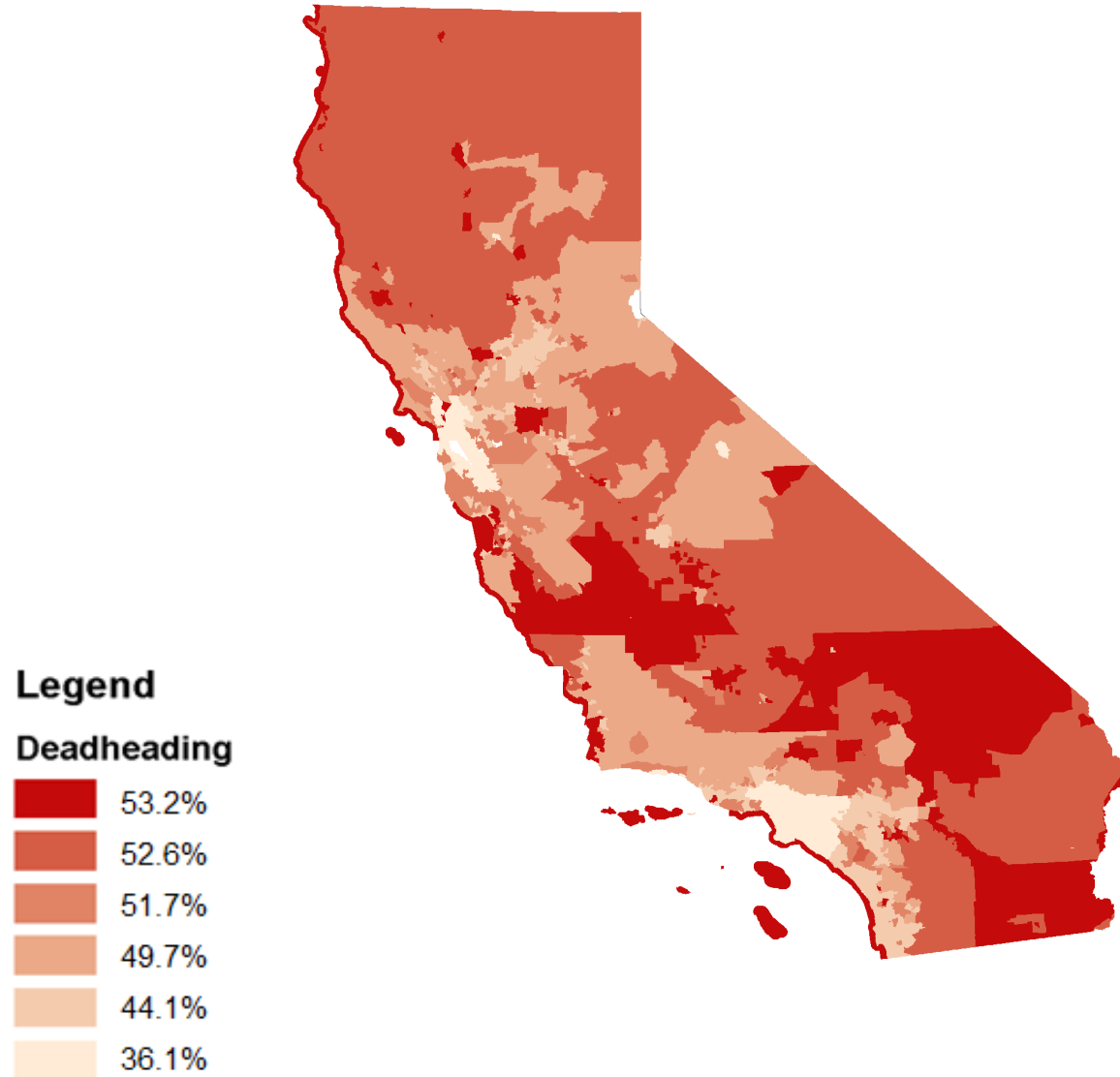
- Occupancy: the number of people on trip, excluding the driver; a key factor determining PMT
- Base Year: TNC statewide average occupancy: 1.55
- BAU Forecast: Assume TNC statewide average occupancy remains constant at 1.55.
- Data Source: CARB data logger study

Deadheading

$$\frac{\text{Grams CO}_2}{\text{PMT}} = \frac{\Sigma (\text{VMT (miles)} \times \text{Adjusted CO}_2 \text{ Emission Rate (g/mile)})}{\Sigma (\text{P3 VMT (miles)} \times \text{Occupancy} + \text{Active/Transit PMT})}$$

- Deadheading: the miles driven while waiting for a rider request and en route to pick up riders (P1+P2); affects total VMT
- Base Year: statewide average 38.5%, varies by geography
- BAU Forecast: Assume deadheading varies by urbanicity and remains constant
- Data Source: 2018 reported TNC data

Deadheading

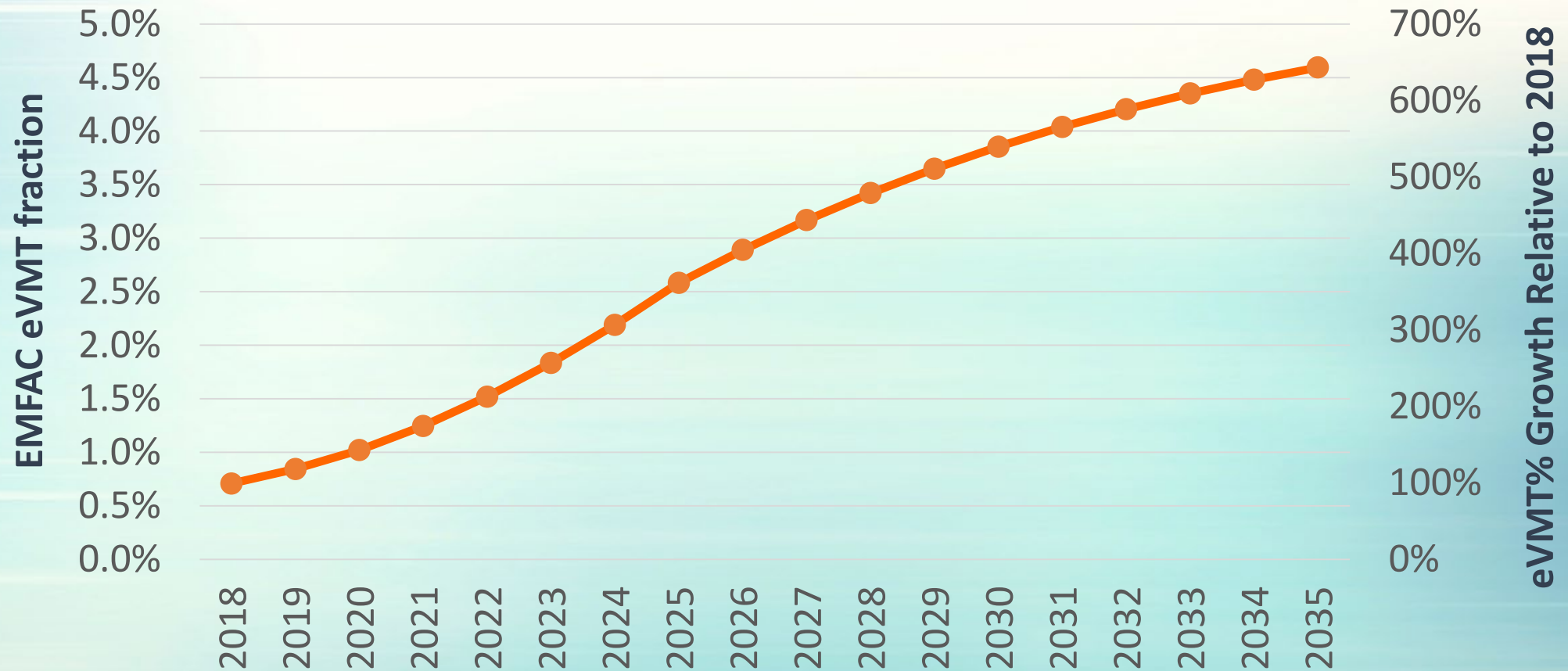


%eVMT

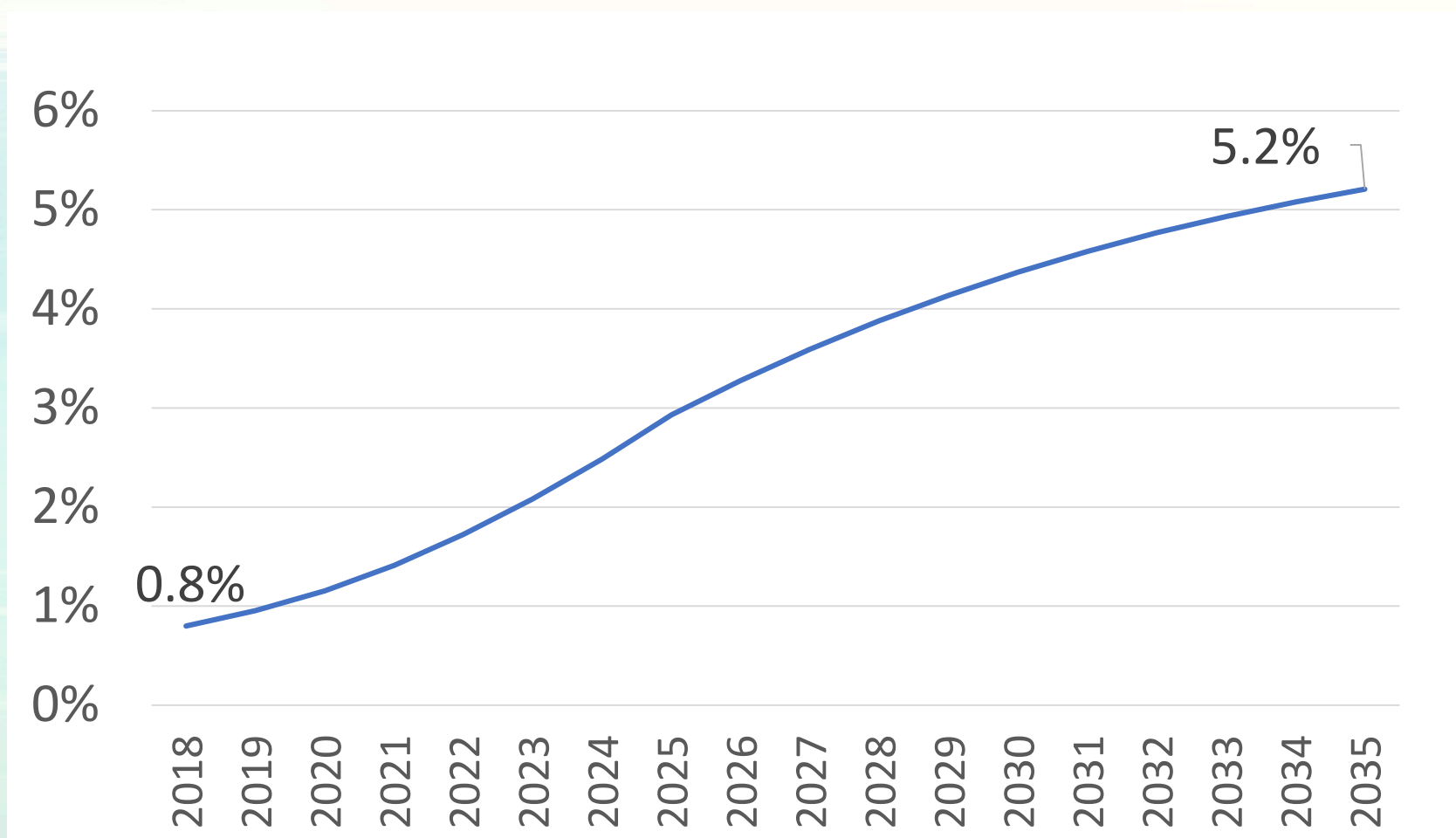
$$\frac{\text{Grams CO}_2}{\text{PMT}} = \frac{\Sigma (\text{VMT (miles)} \times \text{Adjusted CO}_2 \text{ Emission Rate (g/mile)})}{\Sigma (\text{P3 VMT (miles)} \times \text{Occupancy} + \text{Active/Transit PMT})}$$

- %eVMT: fraction of TNC VMT that is driven by BEV, FCEV and PHEVs (electric portion only); eVMT has zero tailpipe emissions
- Base Year: 0.8% on average, varies by geography
- BAU Forecast: assume %eVMT grows at same rate relative to 2018 as what's expected under CARB's Advanced Clean Car (ACC) Reg.
- Data Source: EMFAC2017

eVMT Growth Expected under ACC



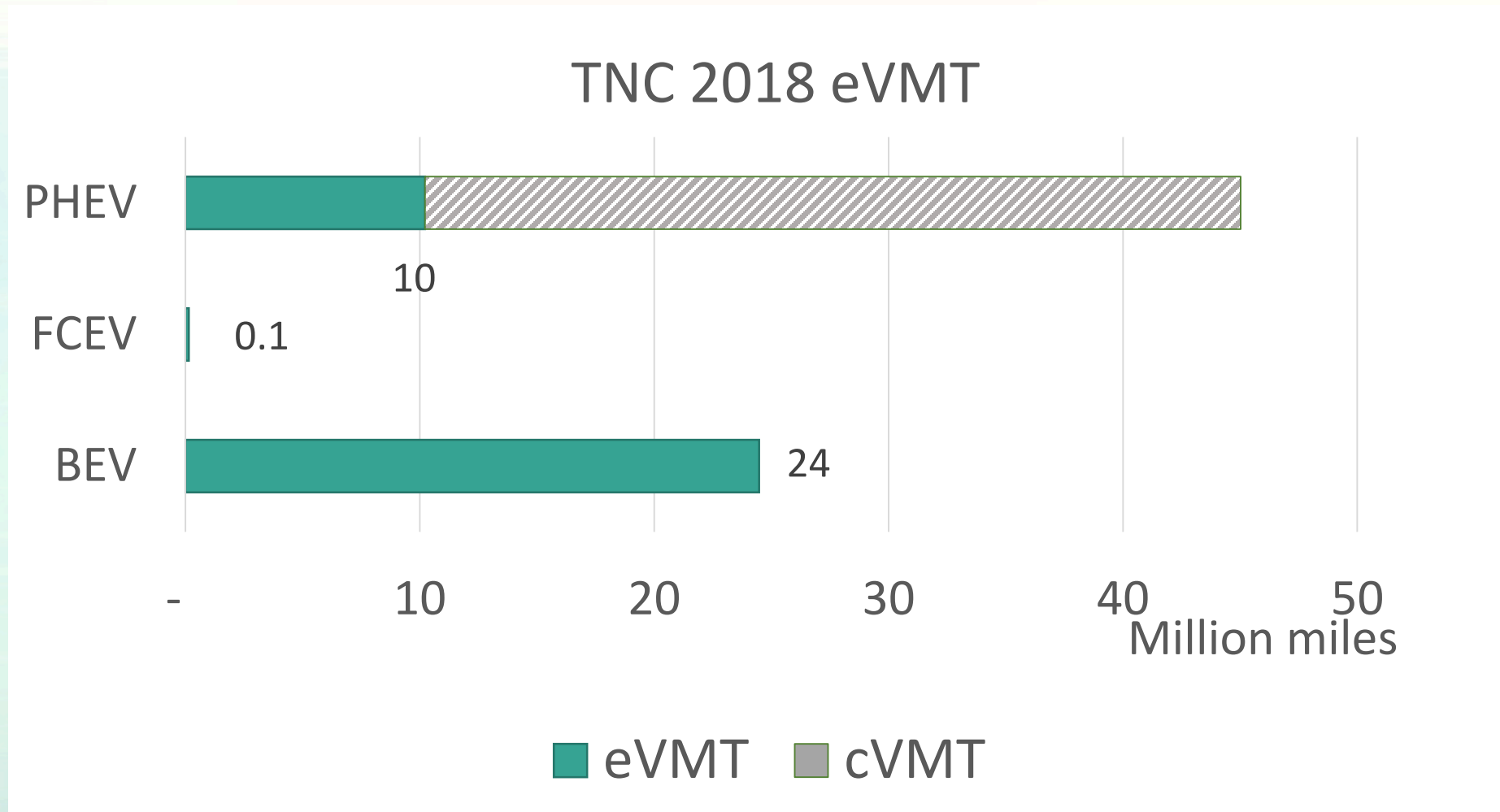
Statewide TNC eVMT Fraction



ZEV Technology Mix

- ZEV Technology Mix: refers to the fractions of eVMT attributable to BEV, FCEV and PHEV
- Base Year Tech Mix:
 - BEV:FCEV:PHEV = 35% : 0.2% : 65%
 - Varies by geography
 - PHEV eVMT fraction: 22.7%
- BAU Forecast: assume fractions remains constant
- Data Sources: 2018 reported TNC data, CARB Base-Year Report

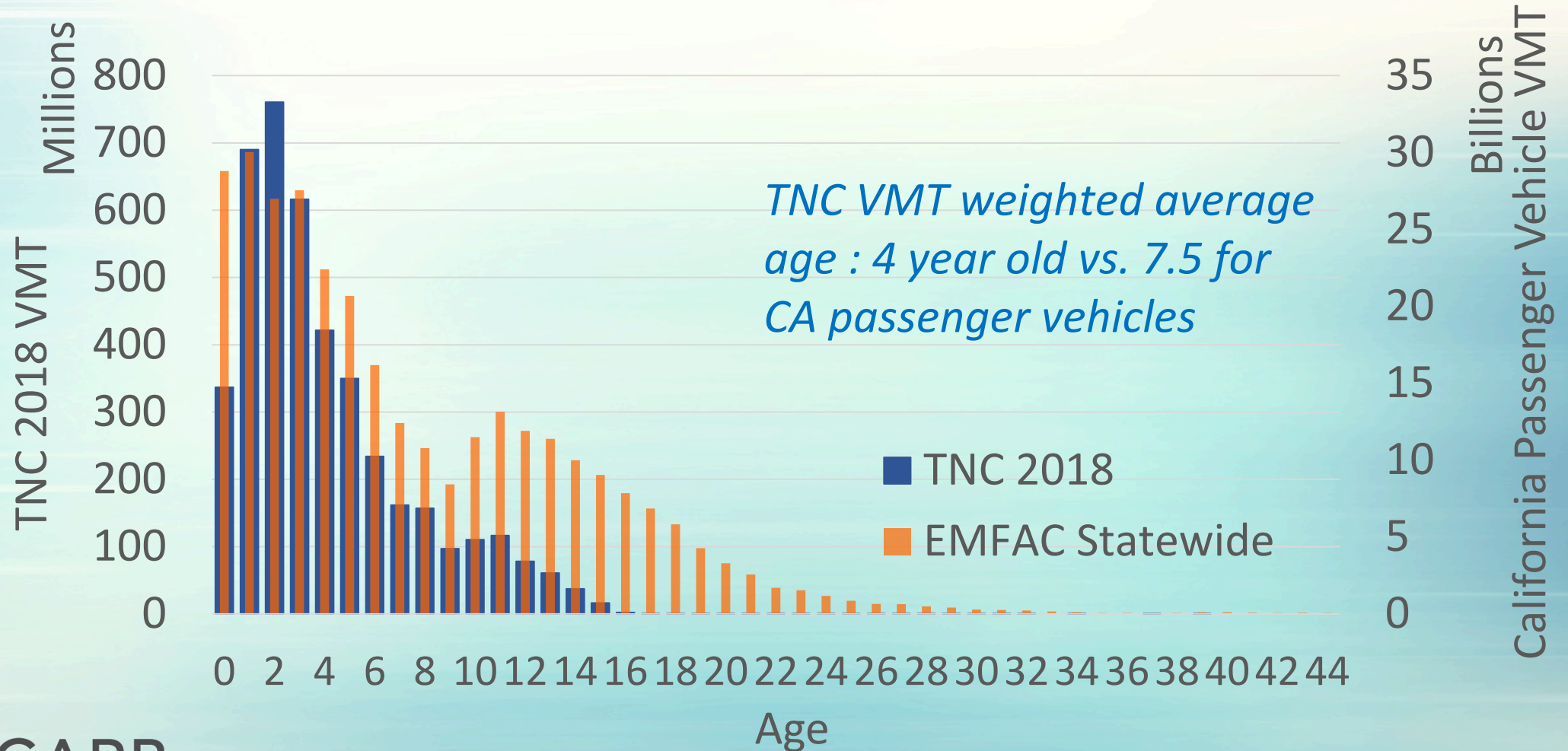
ZEV Technology Mix



Fleet Mix

- Vehicle class mix (i.e. cars vs. trucks) and age distribution; VMT-weighted
- Base Year: 83% cars vs 17% trucks; average age 4 years
- BAU Forecast: Assume vehicle class mix and age distribution remain constant
- Data Source: 2018 reported TNC data

Age Distribution



Adjusted CO₂ Emission Rates

$$\frac{\text{Grams CO}_2}{\text{PMT}} = \frac{\sum (\text{VMT (miles)} \times \text{Adjusted CO}_2 \text{ Emission Rate (g/mile)})}{\sum (\text{P3 VMT (miles)} \times \text{Occupancy} + \text{Active/Transit PMT})}$$

- Base Year: CO₂ emissions based on real-world fuel consumption and TNC in-use speed distribution
- BAU Forecast: CARB emission rates that reflect future clean vehicle programs, and adjusted for TNC-specific speed and technology mix
- Data Source: 2018 reported TNC data, EMFAC2017

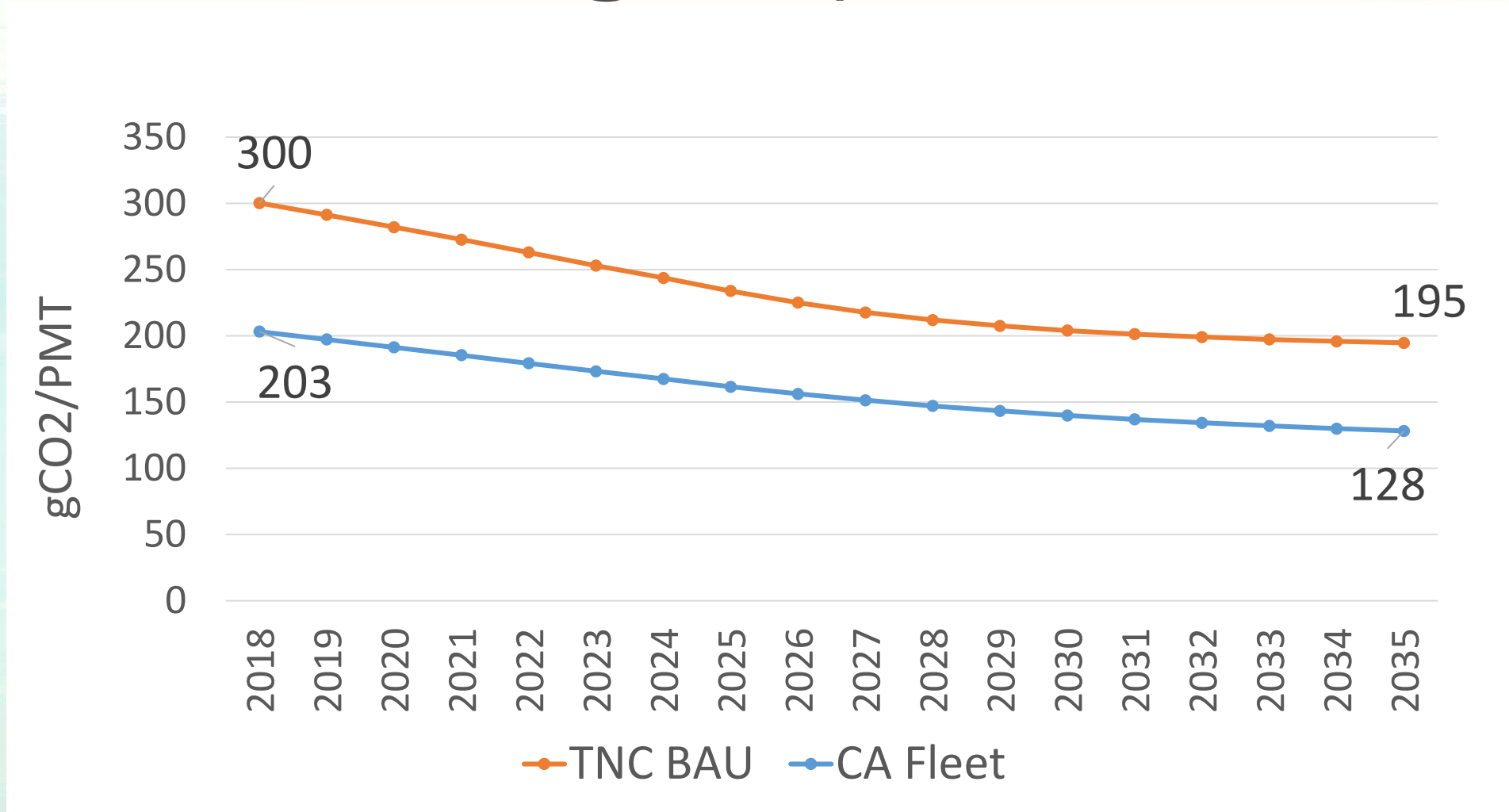
Adjusted CO2 Emission Rates

Adjusted CO2 Emission Rate = EMFAC CO2 emission rate x TNC Correction Factor

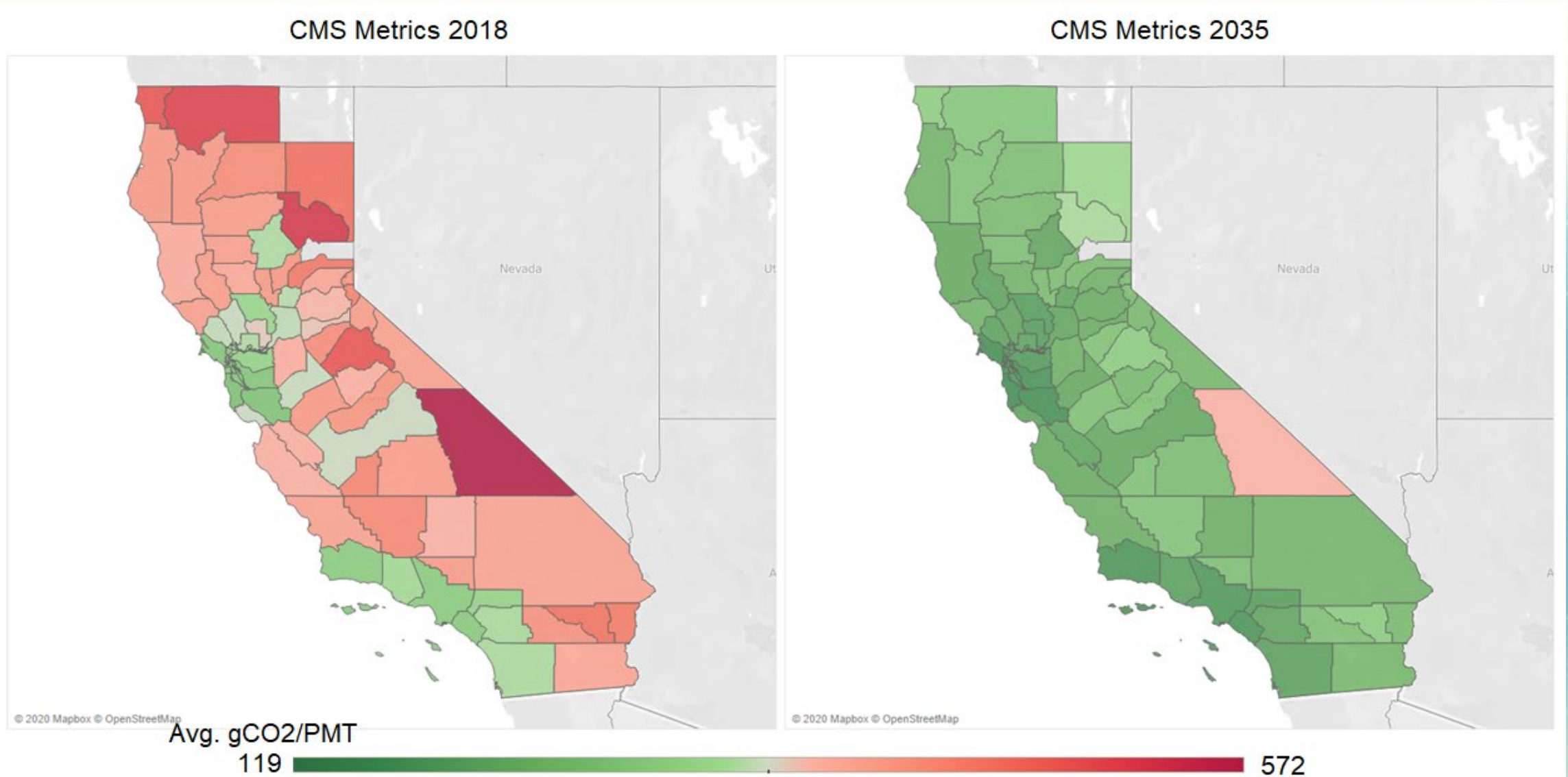
- EMFAC emission rates are specific to calendar year, region, vehicle class, fuel type and model year
- TNC correction factors are developed from the ratios of 2018 TNC emission rates and those of EMFAC for the vehicle of identical region, vehicle class, fuel type and model year.
- Statistical analysis on the relation between ratios and multiple parameters suggests that the ratio primarily varies by vehicle class and fuel type; correction factors estimated from the analysis.

BAU Preliminary Inventory Results

BAU g CO₂/PMT



TNC gCO₂/PMT by Urbanicity



Next Steps

- Refine growth based on recently received historical TNC data from CPUC.
- Refine inputs and assumptions as necessary from stakeholder feedback
- Assess impacts above the BAU case with draft targets
- Preliminary targets and regulatory design (May 5th Workshop)
- Economic Analysis (Summer 2020)
- Public Workshop (Fall 2020)
- Board Hearing (December 2020)

Take Home Questions

- Are these inventory assumptions and methods appropriate?
 - If not, what other methods should CARB consider?
- Are there other data sources or research that CARB should consider?

Comments and Questions

- Please submit your comments related to BAU emission inventory by **April 15**
 - comments can be emailed to cleancars@arb.ca.gov
- For more information on the Clean Mile Standards, please visit our website at: <https://ww2.arb.ca.gov/our-work/programs/clean-miles-standard>