



WHEN TRUST MATTERS

# Dude, Where's My (Electric) Car?

## Residential EV Adoption Forecasting

Walter Schaefer, DNV

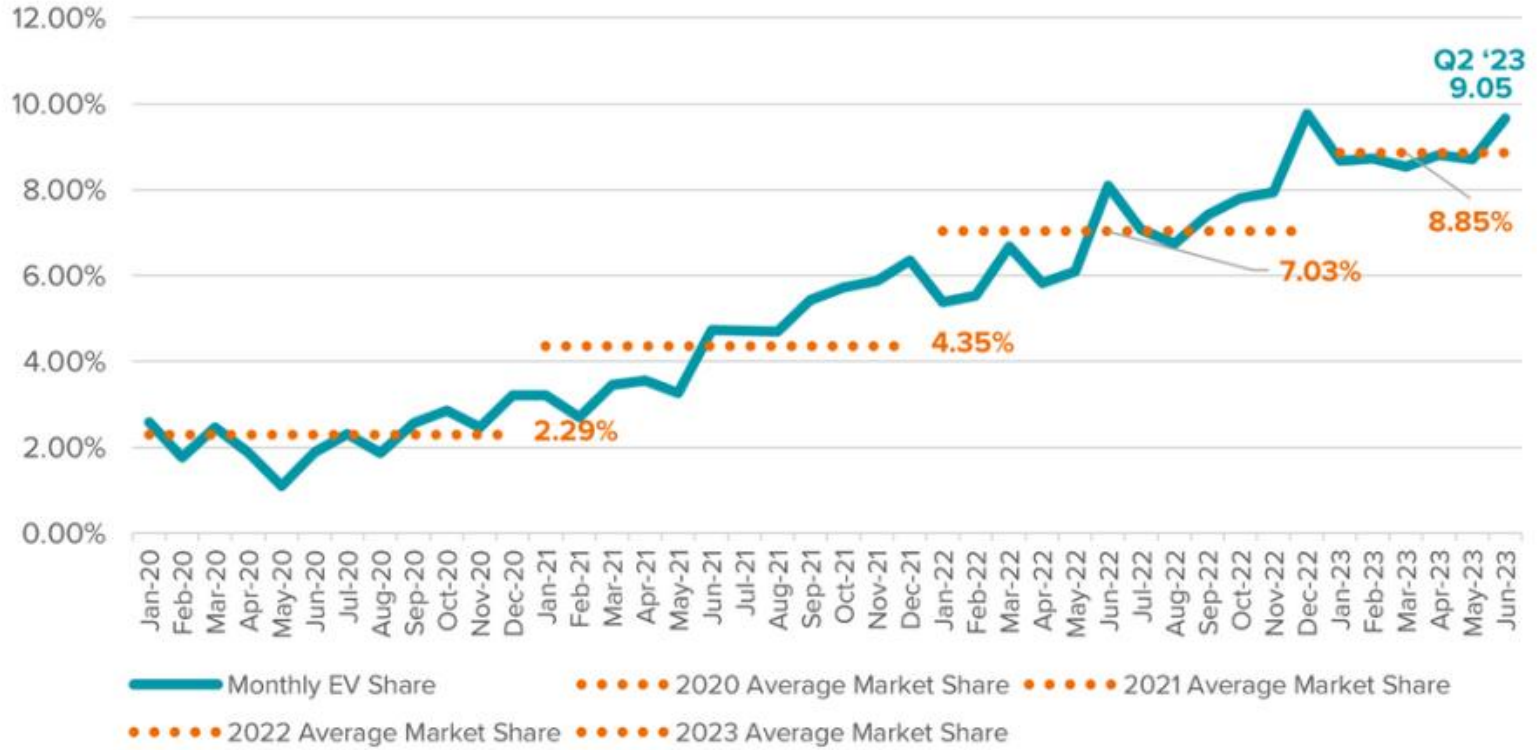
BECC  
November 14, 2023

# Agenda

- Today's EV adoption landscape
- Utilities' EV adoption challenges and opportunities
- Agent-based modeling approach to EV adoption forecasting
- Takeaways and considerations

# EV Adoption has accelerated in the US

EV MARKET SHARE: JANUARY 2020 - JUNE 2023



There will be ~3.2M EVs on US roads by EOY 2023 – about 1% of all US cars!

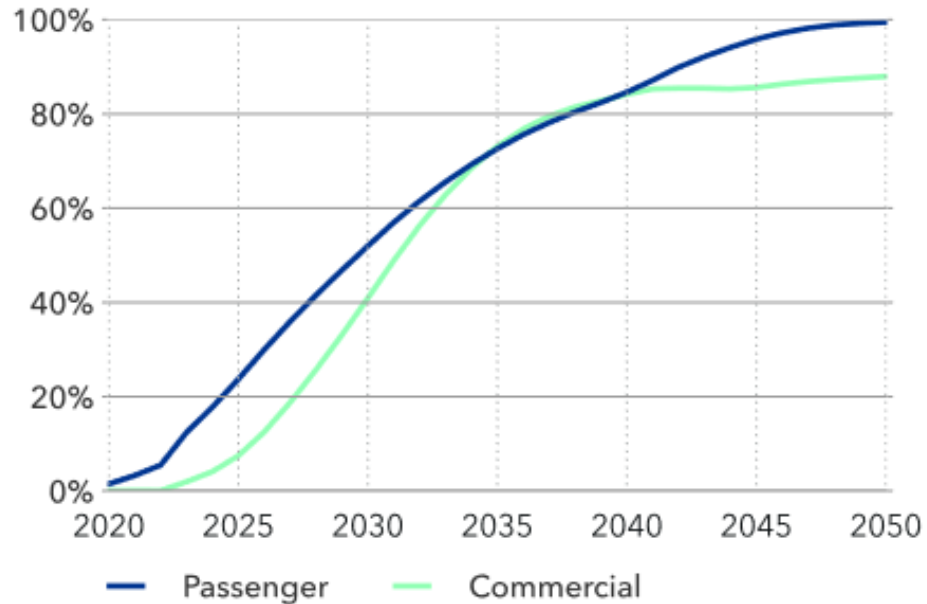
Source: Graphic and stats: Alliance for Automotive Innovation Get Connected: Electric Vehicle Quarterly Report 2023 (Q2). <https://www.autosinnovate.org/posts/papers-reports/get-connected-q2-2023>



# EVs are forecasted to dominate by 2050

**Market share of electric vehicles**

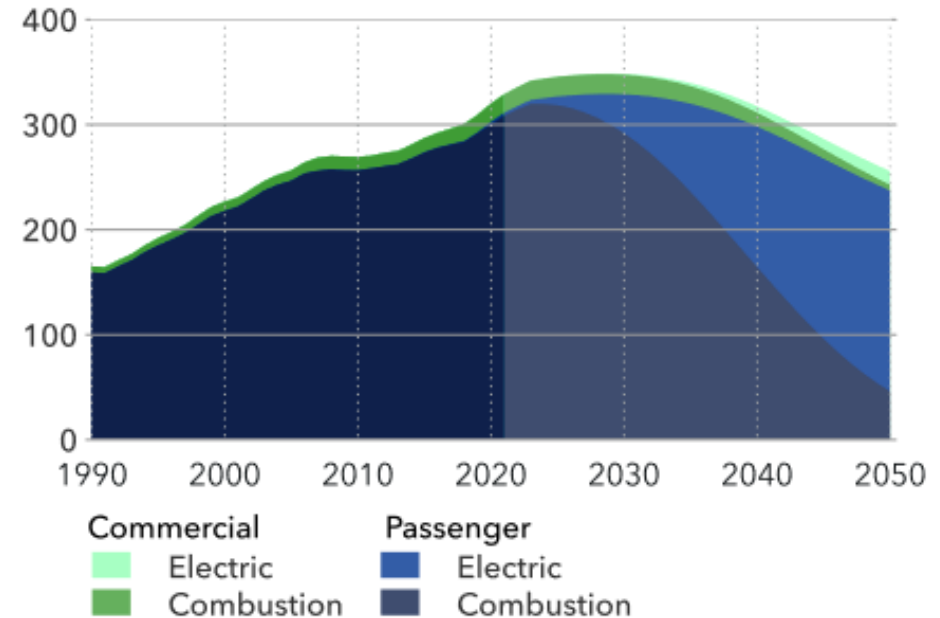
Units: Percentages



Electric vehicles include BEVs and FCEVs.  
Historical data source: Marklines (2022), IEA EV Outlook (2022), EV Volumes (2022)

**Number of road vehicles by type and drivetrain**

Units: Million vehicles



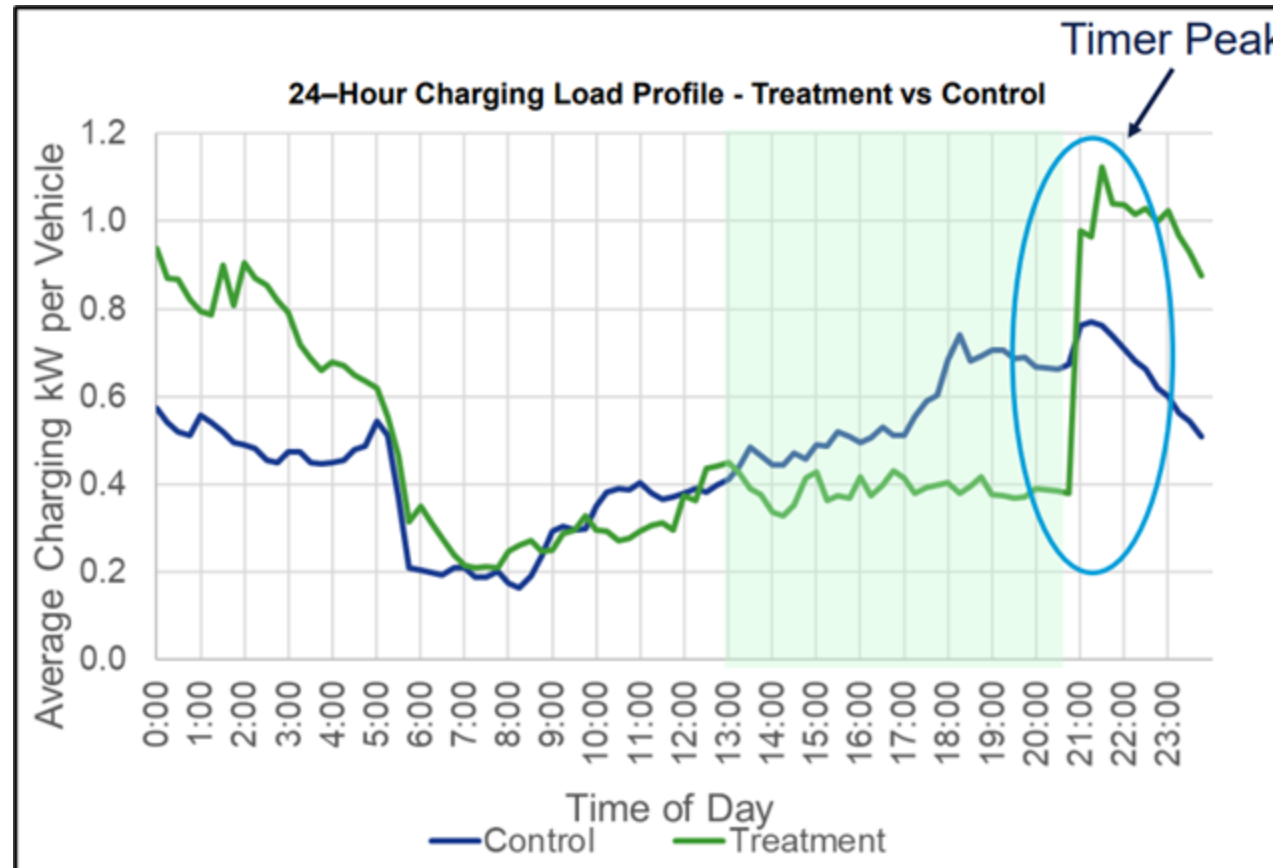
Historical data source: Marklines (2022), IEA EV Outlook (2022), EV Volumes (2022)  
Combustion vehicles include ICEs and PHEVs. Electric vehicles include BEVs and FCEVs

**Source:**

DNV's Energy Transition Outlook, North America (2023).

<https://www.autosinnovate.org/posts/papers-reports/get-connected-q2-2023>

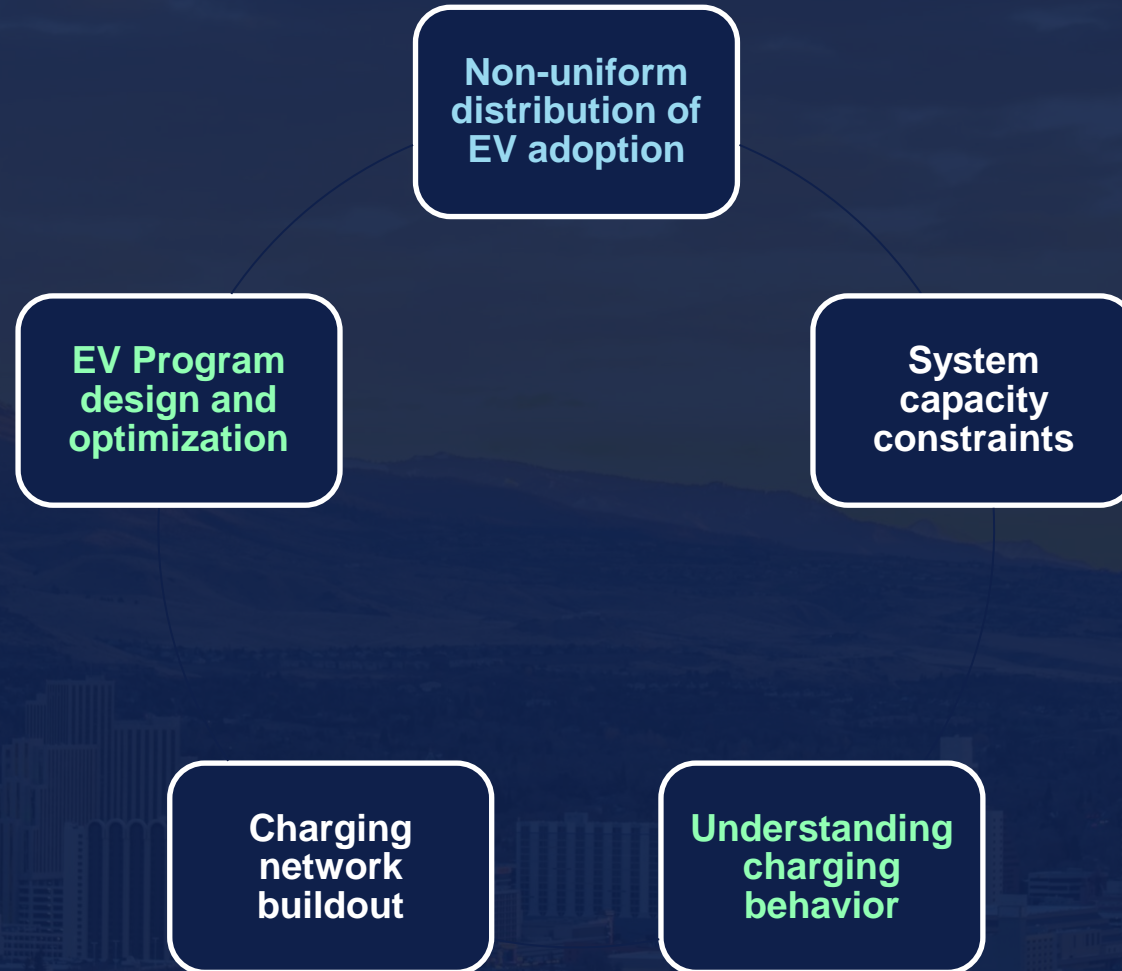
# EV charging poses peak load and timer peak challenges, especially at the local level



**Source:**

Rhode Island Electric Transportation Initiative Evaluation Final Report – Rate Year 2. DNV.  
10/23/2020. <https://ripuc.ri.gov/sites/g/files/xkgbur841/files/eventsactions/docket/4770-NGrid-RY2-Transportation-Initiative-Annual-Report-Combined-%2810.30.2020%29.pdf>

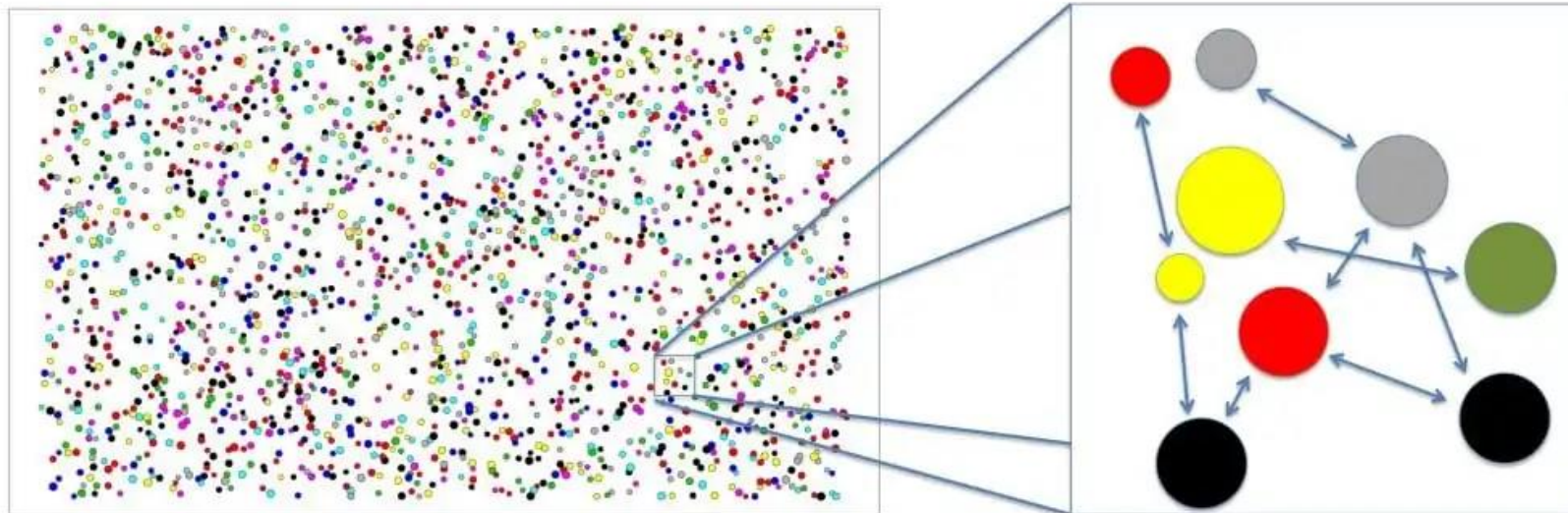
# EV Adoption Forecasting: A multitude of challenges for utilities



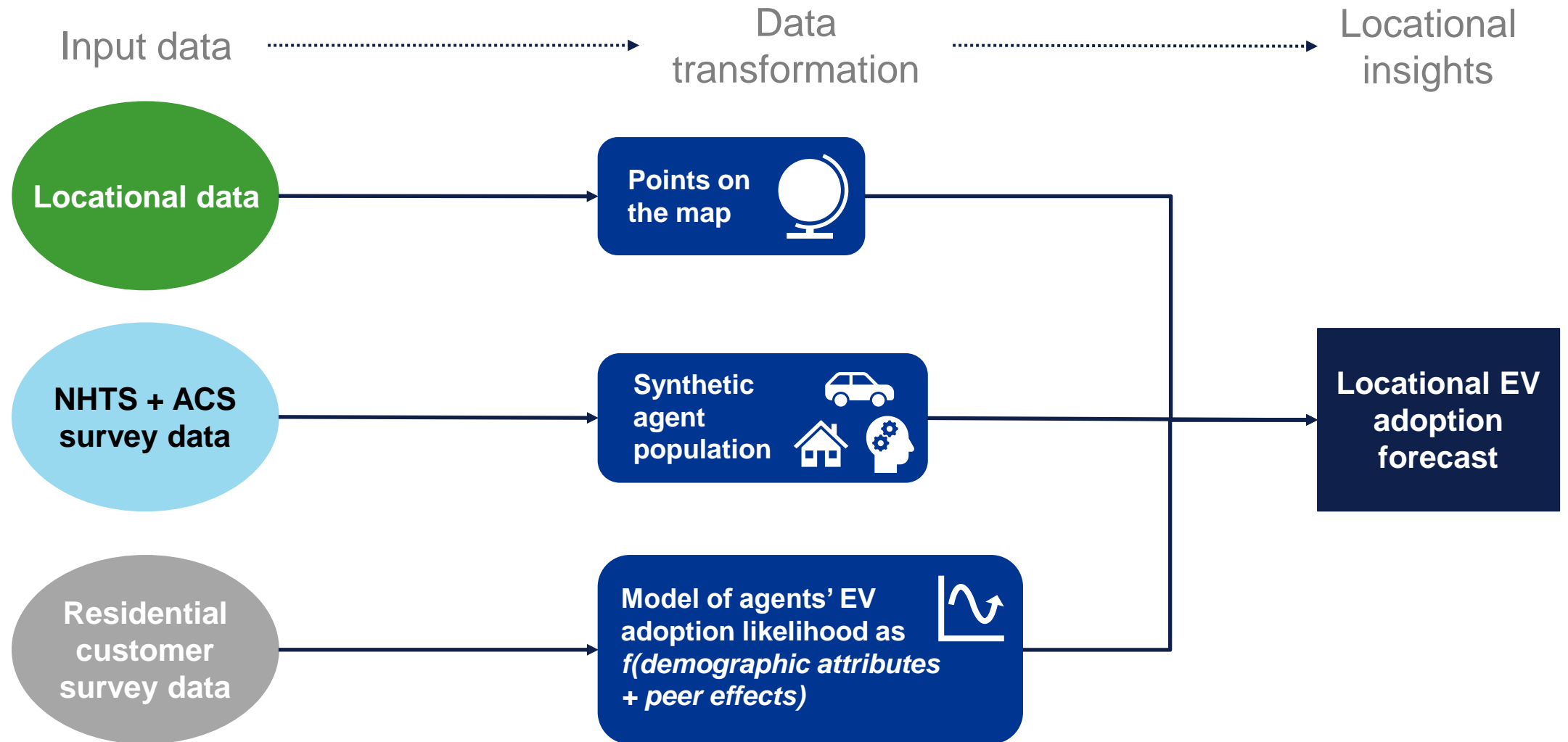
# EVAF: Agent-based model (ABM) overview

The ABM approach allows us to model the behavior of a complex system of agents, each of which can independently:

- Evolve – by changing attributes over time (e.g., aging, increasing income)
- Act – make and act upon decisions, such as buying or selling a vehicle
- Interact – with other agents, including influencing and being influenced



# Agent-based Model (ABM) Framework





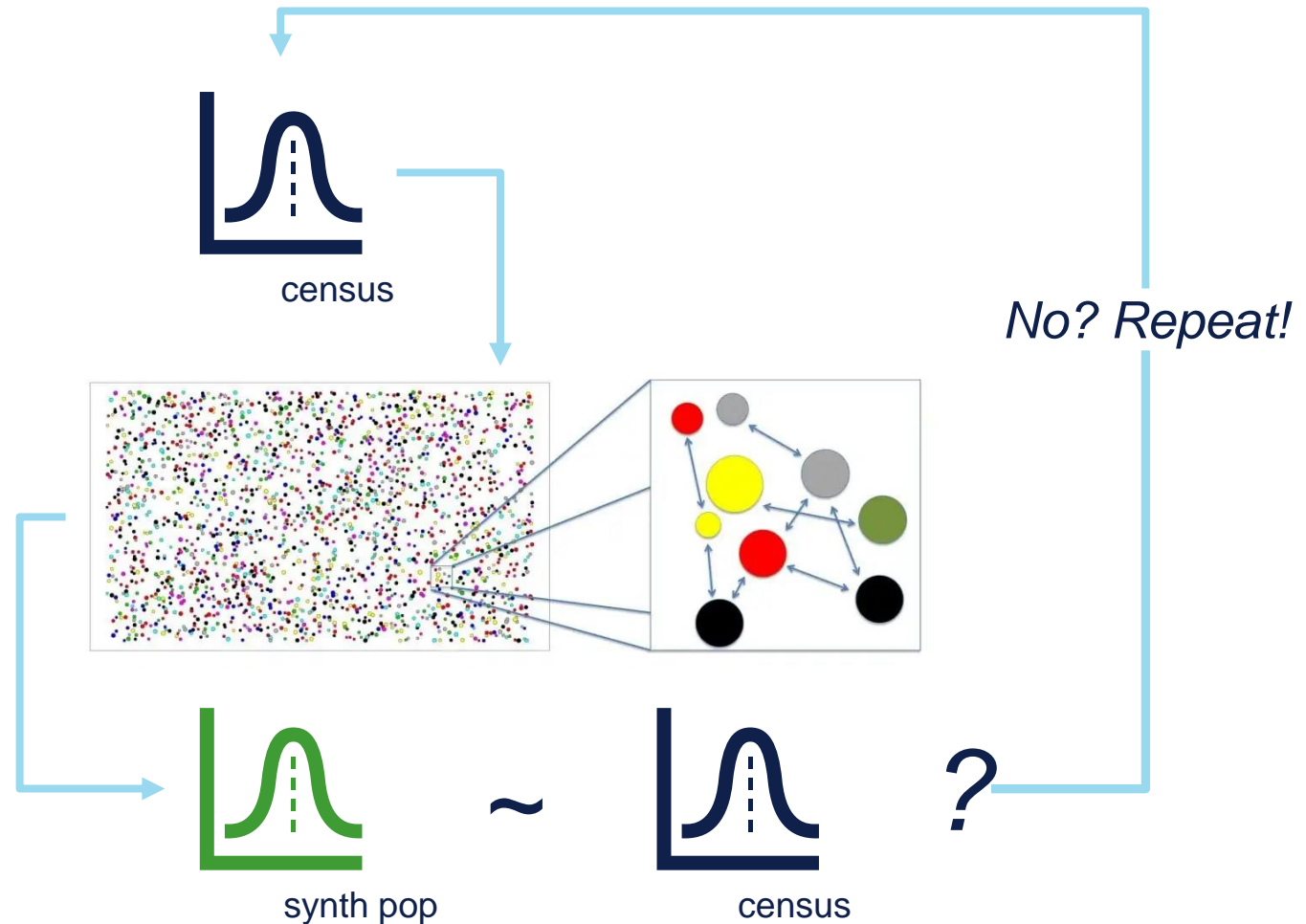
# Synthetic population generation: household agents

- Initialize by “putting points on the map”
- Sourced from tax parcel data, utility customer datasets, or other sources
- Captures real-world housing configuration and density
- Census block group resolution



# Synthetic population generation: consumer and vehicle agents

- Analyze Census data to determine distribution of population attributes
  - *Consumers*: Household size, income, education level, etc.
  - *Vehicles*: Age, mileage, distance traveled
- Assign attributes to individual agents within synthetic population
- Compare synthetic population and Census attribute distributions
- Iterate until sufficient alignment is achieved along multiple dimensions

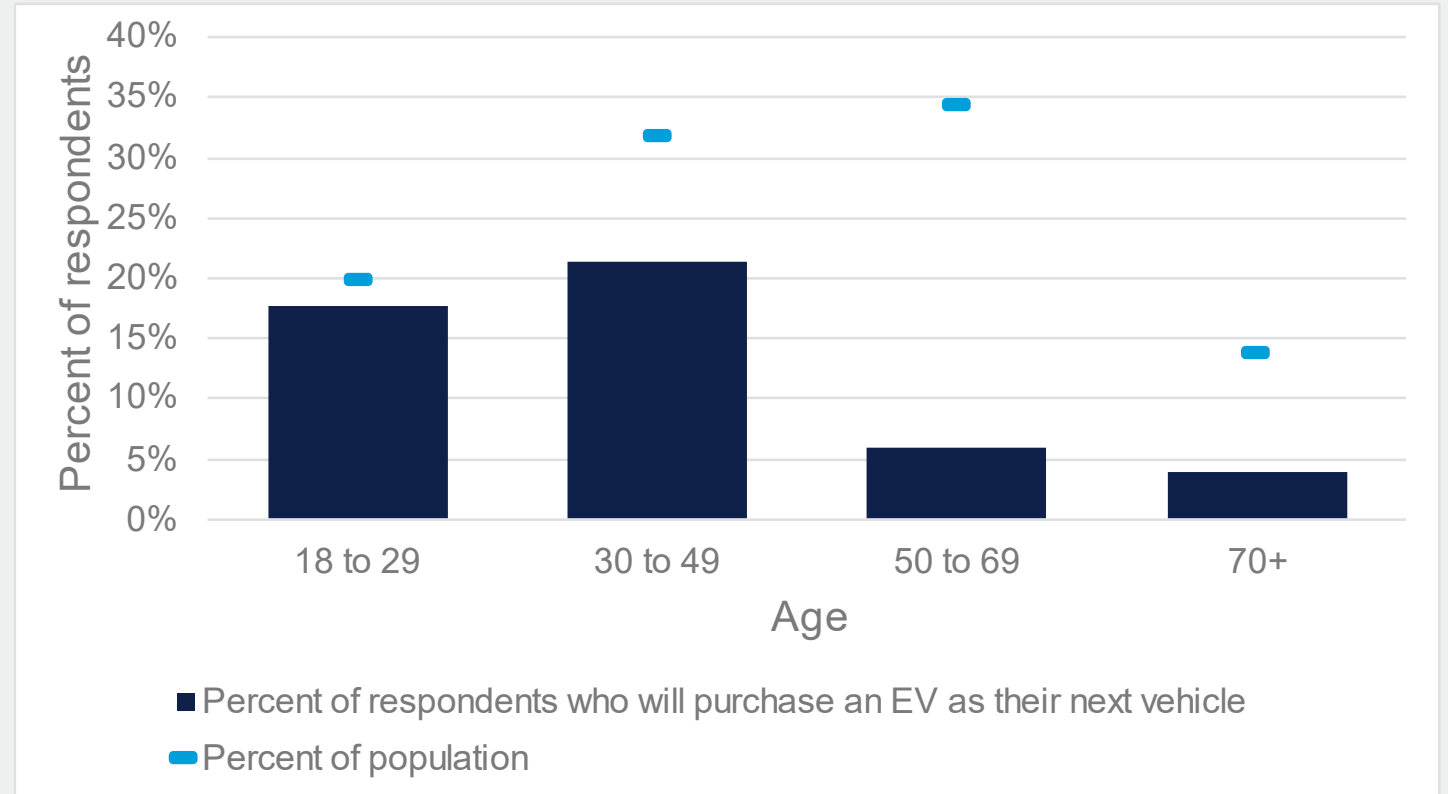


# Modeling EV adoption behavior

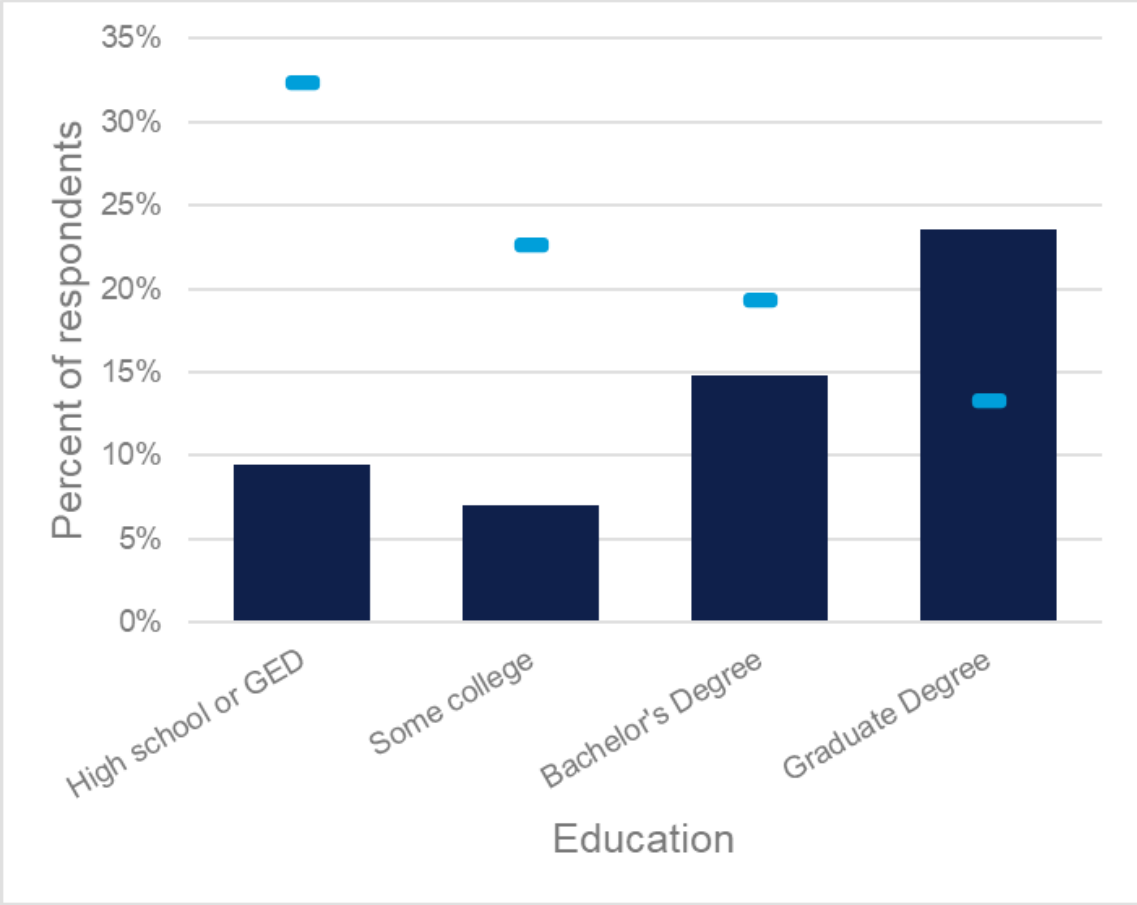
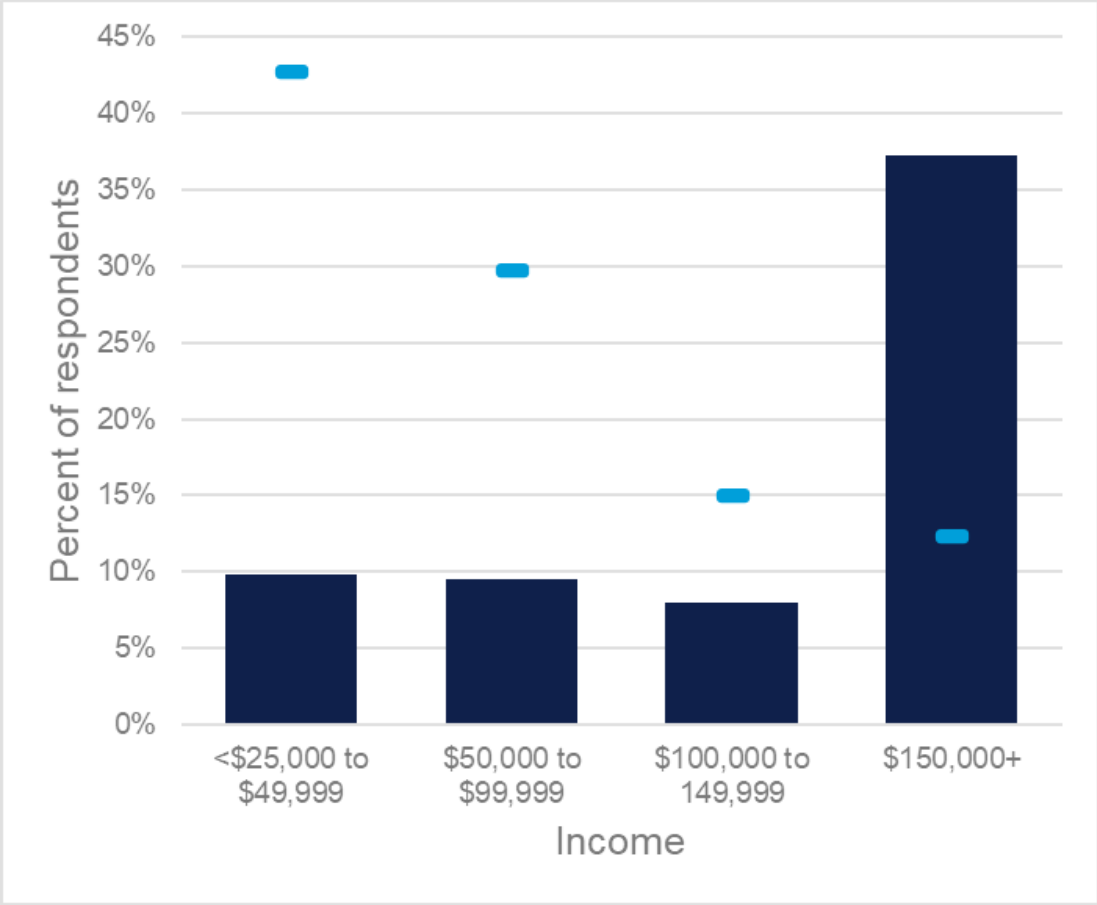


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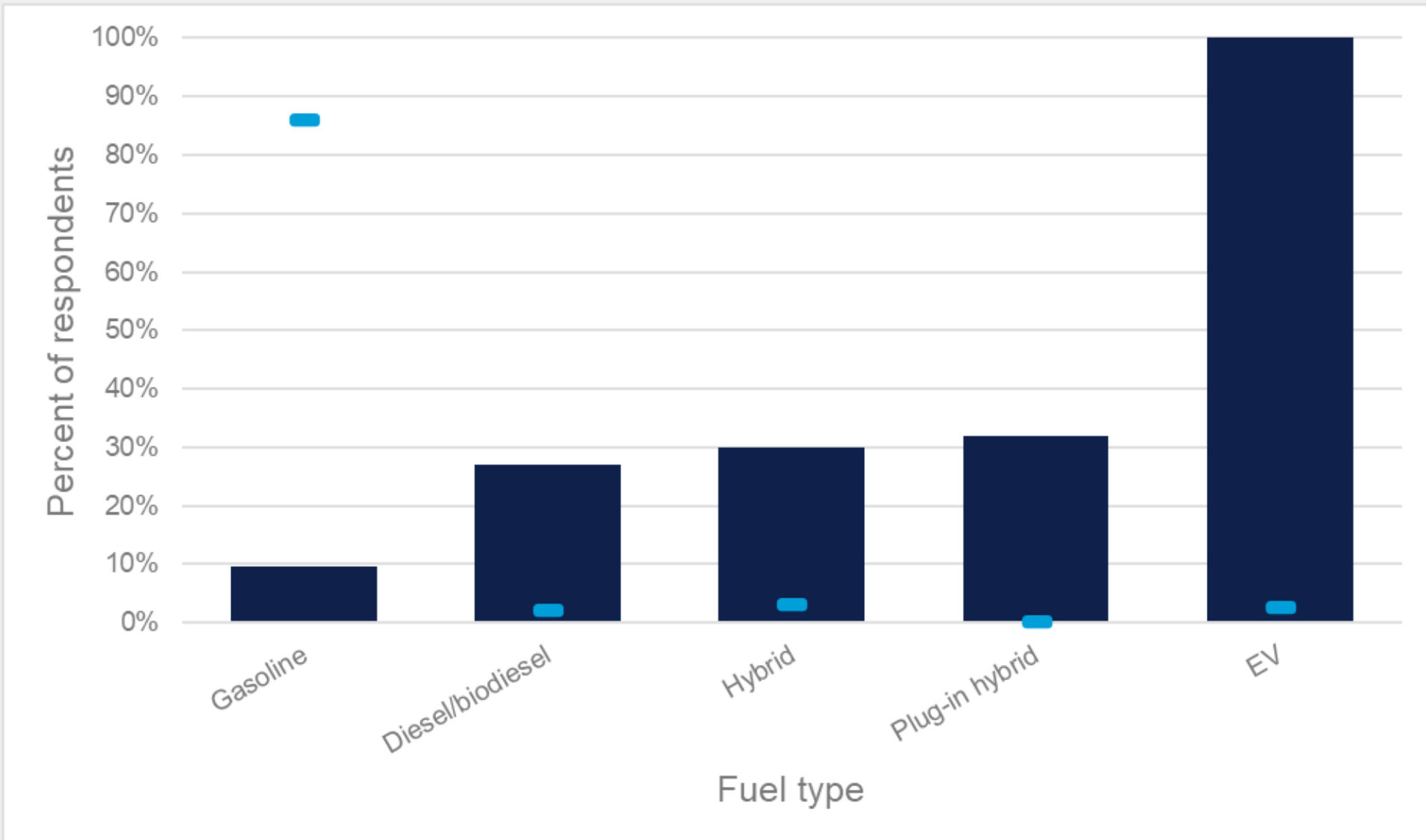
- Survey fielded among residential customers
- Key response: stated likelihood to adopt an EV on a 1-5 scale
- Regression analysis links survey responses to demographics along multiple dimensions
- Survey approach facilitates robust capture of local attitudes in a fast-changing market



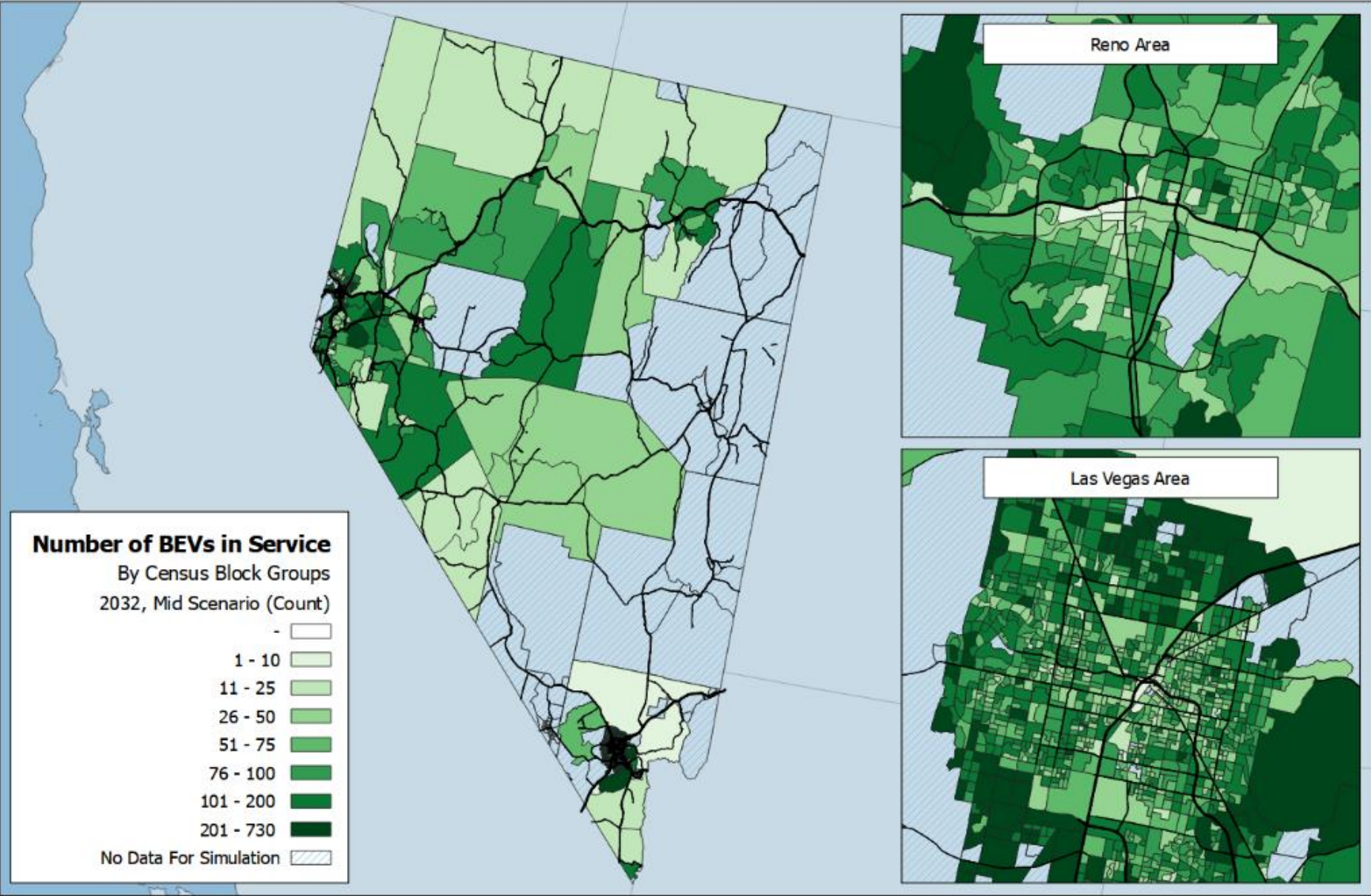
# Modeling EV adoption behavior



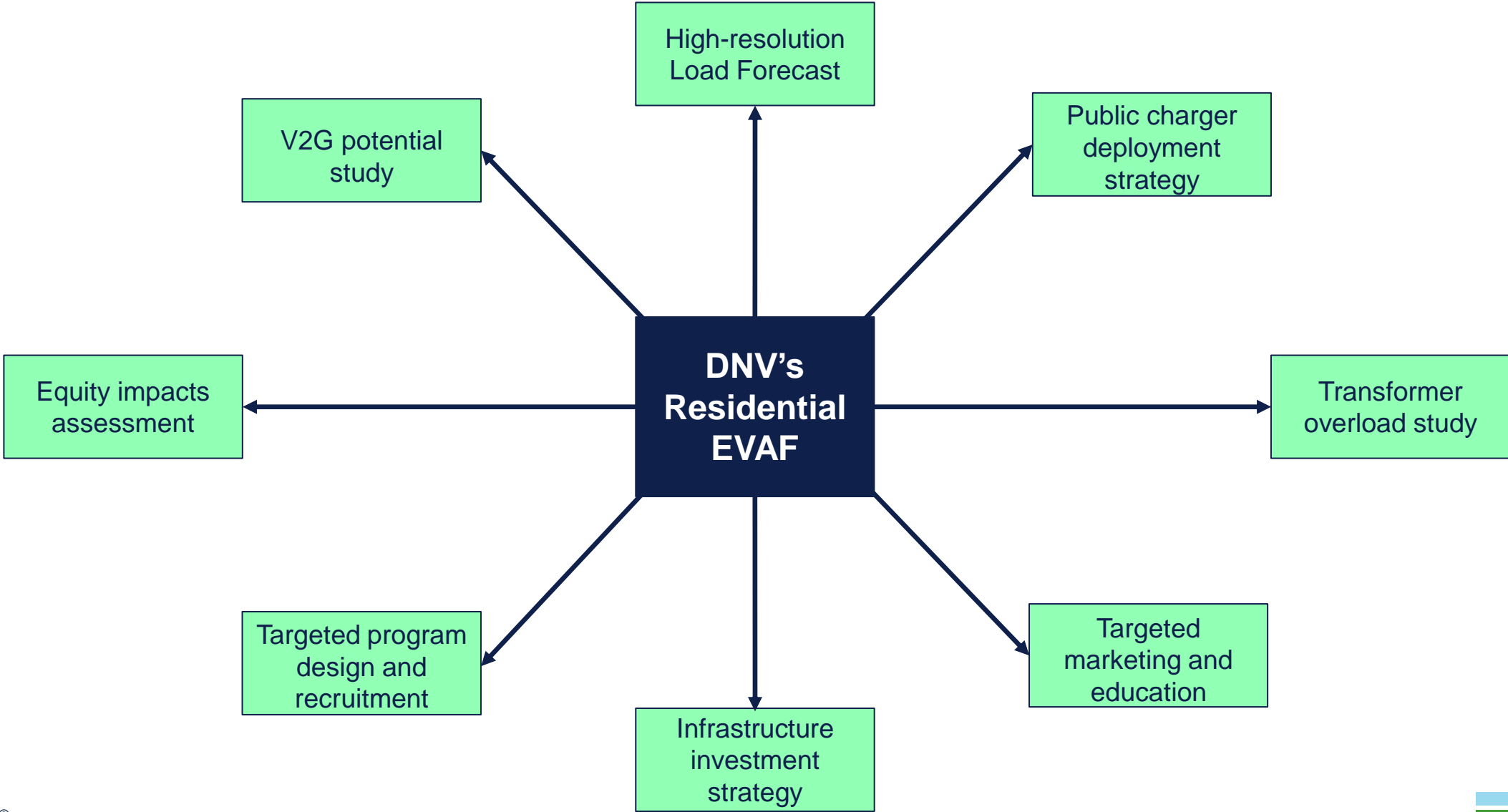
# An opportunity for utilities!



# Forecast outputs



# EVAF Use Cases





# DNV's EV Forecasting Approach

High locational granularity – down to the census block group (or feeder)

Leverages real customer EV beliefs, attitudes, and purchase propensity data

Captures both demographic and peer effect influences on purchase behavior

Integrates expertise in EV charging data analytics, managed charging, and demand response to develop robust load forecasts

# Thank you!

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