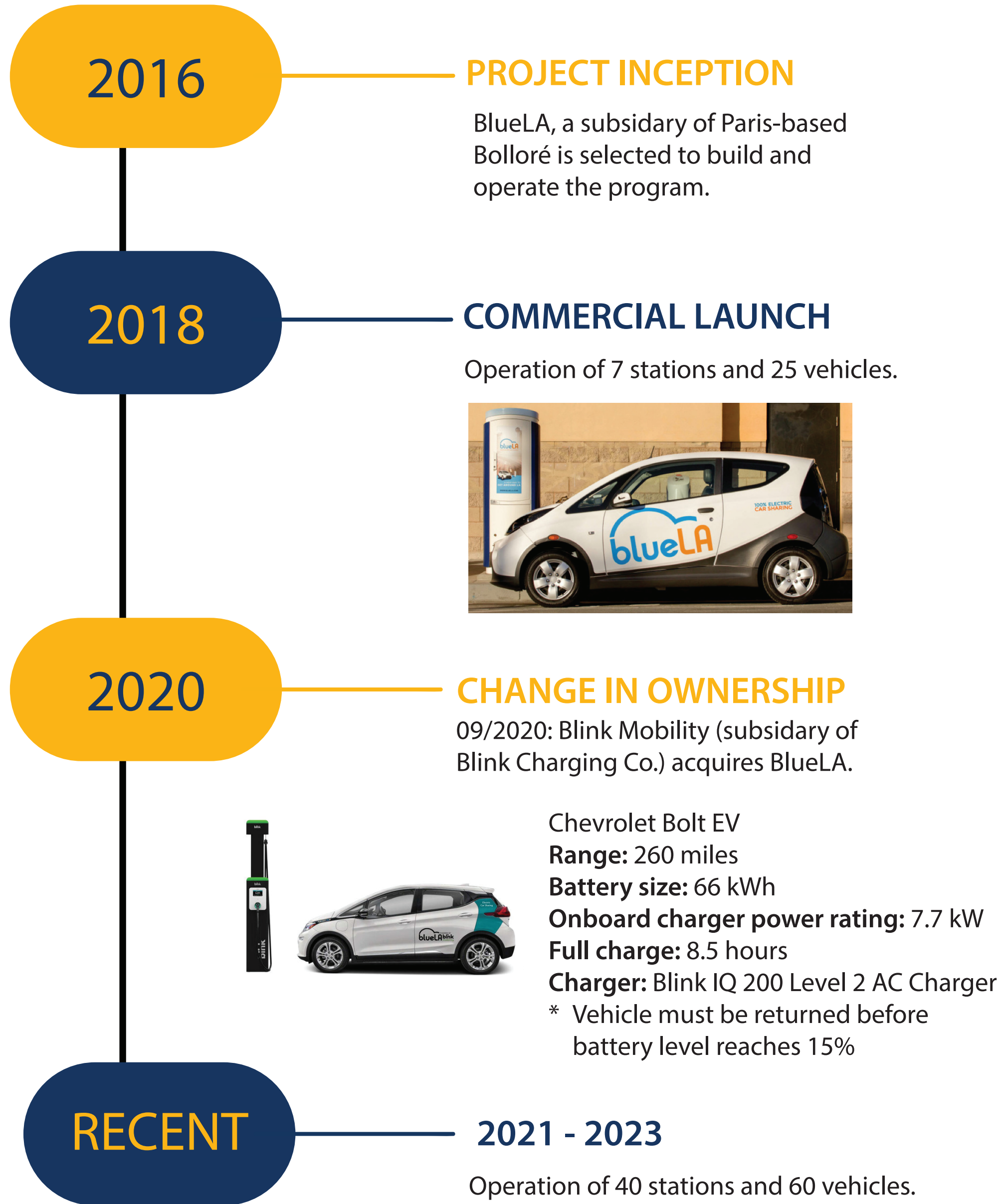# CAN ELECTRIC VEHICLE CARSHARING BRIDGE THE GREEN DIVIDE?

A Study of BlueLA's Environmental Impacts Among Underserved Communities and the Broader Population

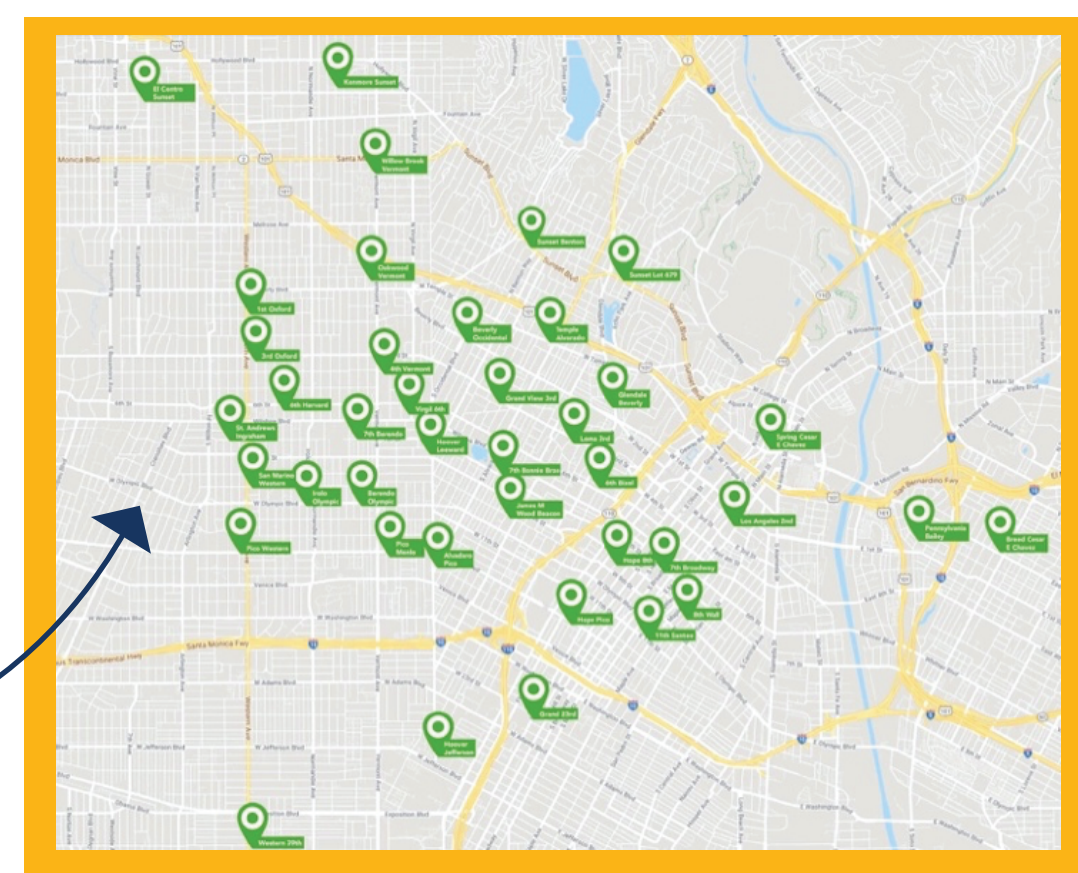Ziad Yassine, M.S., Elliot W. Martin, Ph.D., Susan A. Shaheen, Ph.D.

BACKGROUND

- **Project Development:** In 2016 the City of LA embarked on an EV carsharing pilot project through a grant from CARB.
- **Aim:** Pilot EV carsharing in low-income communities.
- **Aligns with CARB's vision:** Supporting transportation, climate change mitigation, and improved access for underserved communities.

2016 — PROJECT INCEPTION
BlueLA, a subsidiary of Paris-based Bolloré is selected to build and operate the program.

2018 — COMMERCIAL LAUNCH
Operation of 7 stations and 25 vehicles.

2020 — CHANGE IN OWNERSHIP
09/2020: Blink Mobility (subsidary of Blink Charging Co.) acquires BlueLA.

Chevrolet Bolt EV
Range: 260 miles
Battery size: 66 kWh
Onboard charger power rating: 7.7 kW
Full charge: 8.5 hours
Charger: Blink IQ 200 Level 2 AC Charger
* Vehicle must be returned before battery level reaches 15%

RECENT — 2021 - 2023
Operation of 40 stations and 60 vehicles.

2021
- 1,650 members
- 25,000 trips

2022
- 2,100 members
- 34,000 trips

NEIGHBORHOODS
- Westlake
- Koreatown
- Pico-Union
- Downtown
- Echo Park
- Boyle Heights
- Chinatown

PRICING

STANDARD	
Membership fee	$5 per month
Rental Fee	20¢ per min
Minimum Period	15 mins
Maximum Period	12hrs

* 3 & 5 hour discounted rental packages are also available

COMMUNITY (LOW-INCOME)	
Membership fee	$1 per month
Rental Fee	15¢ per min
Minimum Period	15 mins
Maximum Period	12hrs

* 3 & 5 hour discounted rental packages are also available

ABSTRACT

This study aims to evaluate the potential of electric vehicle (EV) carsharing services to address social and environmental disparities in urban transportation through an evaluation of BlueLA, a one-way station-based carsharing service in Los Angeles, California. BlueLA provides a clean and affordable mobility option in underserved communities that face significant air quality burdens and have historically been excluded from environmental benefits. By incorporating BlueLA trip activity data from January 2021 to December 2022 (n=59,112 trips) and an online user survey implemented in early-December 2022 (n=215 responses), we estimate the impacts of BlueLA on personal vehicle ownership patterns, vehicle miles traveled (VMT), and associated greenhouse gas (GHG) emissions. Results show an overall net reduction in VMT and GHG emissions of 463,845 miles and 656 metric tons, respectively, among the BlueLA user population (3,074 registered users). When disaggregating impacts by BlueLA member type, our findings show a net reduction of 234 and 371 metric tons in GHG emissions for Standard (general population) and Community (low-income qualified) members, respectively. Moreover, when comparing the emissions produced by the electric fleet of BlueLA to those of a comparable fleet of internal combustion engine vehicles, we find that the use of an EV fleet reduces GHG emissions by 43% in comparison. The BlueLA carsharing service has led to notable net reductions in VMT and thus GHG emissions, with a major share of these reductions observed among Community members.

METHODS

Objective: Assess the impact of BlueLA on Vehicle Miles Traveled (VMT) and Greenhouse Gas (GHG) emissions.
Data Sources: Detailed trip activity data & comprehensive user survey
Focus: Understand driving behavior, vehicle ownership patterns, and environmental impact.

DATA COLLECTION

USER SURVEY
- **Administered:** Through Qualtrics in December 2022
- **Languages:** English and Spanish to cater to BlueLA's diverse user base.
- **Incentive:** Chance to win one of 40 Amazon gift cards ($50 value each).
- **Target population:** Active and inactive BlueLA members.
- **Activity status:** Defined based on the status of a user's BlueLA membership at the time of survey implementation.
- **Responses**
  ○ **Total responses:** 215.
  ○ **Language:** 213 English responses, 2 Spanish responses.
  ○ **Activity status:** 60% active members, 40% inactive members.

TRIP ACTIVITY DATA
- **Timeframe:** Data from 2021 and 2022.
- **Data Structure:** Each row represents a unique trip with attributes like member type, start/end times, locations, battery charge levels, and distance.
- **Total Trips:** N ≅ 59,000 trips
  ○ 49% by Standard members
  ○ 51% by Community members
- **Total Users:** N ≅ 3,000 users
  ○ 63% Standard members
  ○ 37% Community members
- **User Growth**
  ○ **2021:** N ≅ 1,000 Standard members, N ≅ 650 Community members.
  ○ **2022:** N ≅ 1,300 Standard members, N ≅ 800 Community members.

IMPACTS ON VEHICLE OWNERSHIP & USE

USER SURVEY INSIGHTS
- Vehicle shedding
- Vehicle postponement
- Change in driving behavior

ADDRESSING BIAS
- Weighting process used to ensure survey data accurately represents the entire BlueLA user population
- Weighting is based on usage frequency levels observed in the activity data
- **Match Rate:** 63% between active survey respondents and trip activity data
- **Sample Size:** 81 matched and active survey respondents

CHARGING DATA INTERFERENCE
- **Vehicle States:** "In-trip", "charging", and "fully charged"
- **Charging Duration:** Based on Chevrolet Bolt EVs' battery specs
- **Battery size:** 66 kWh
- **Onboard charger power rating:** 7.7 kW
- **Data Processing:** Used Python to infer charging data, address inconsistencies, and create a dataset for vehicle charging patterns

CALCULATION OF BlueLA'S VMT & GHG

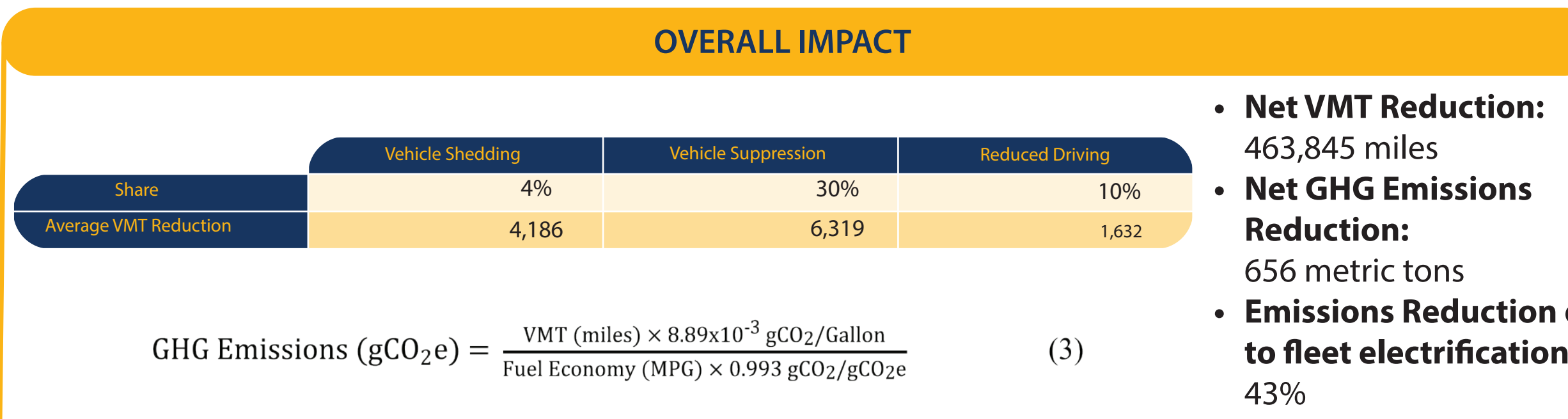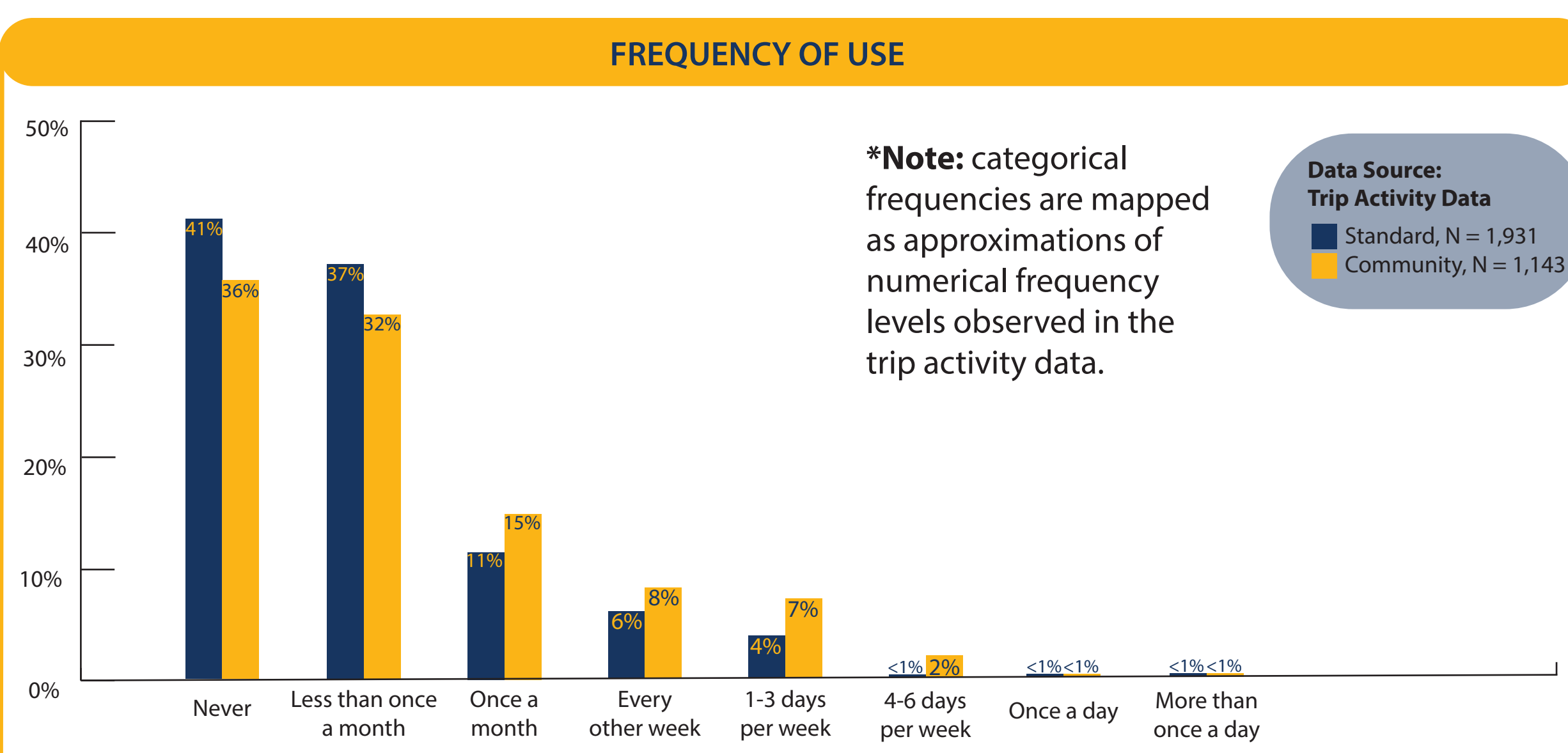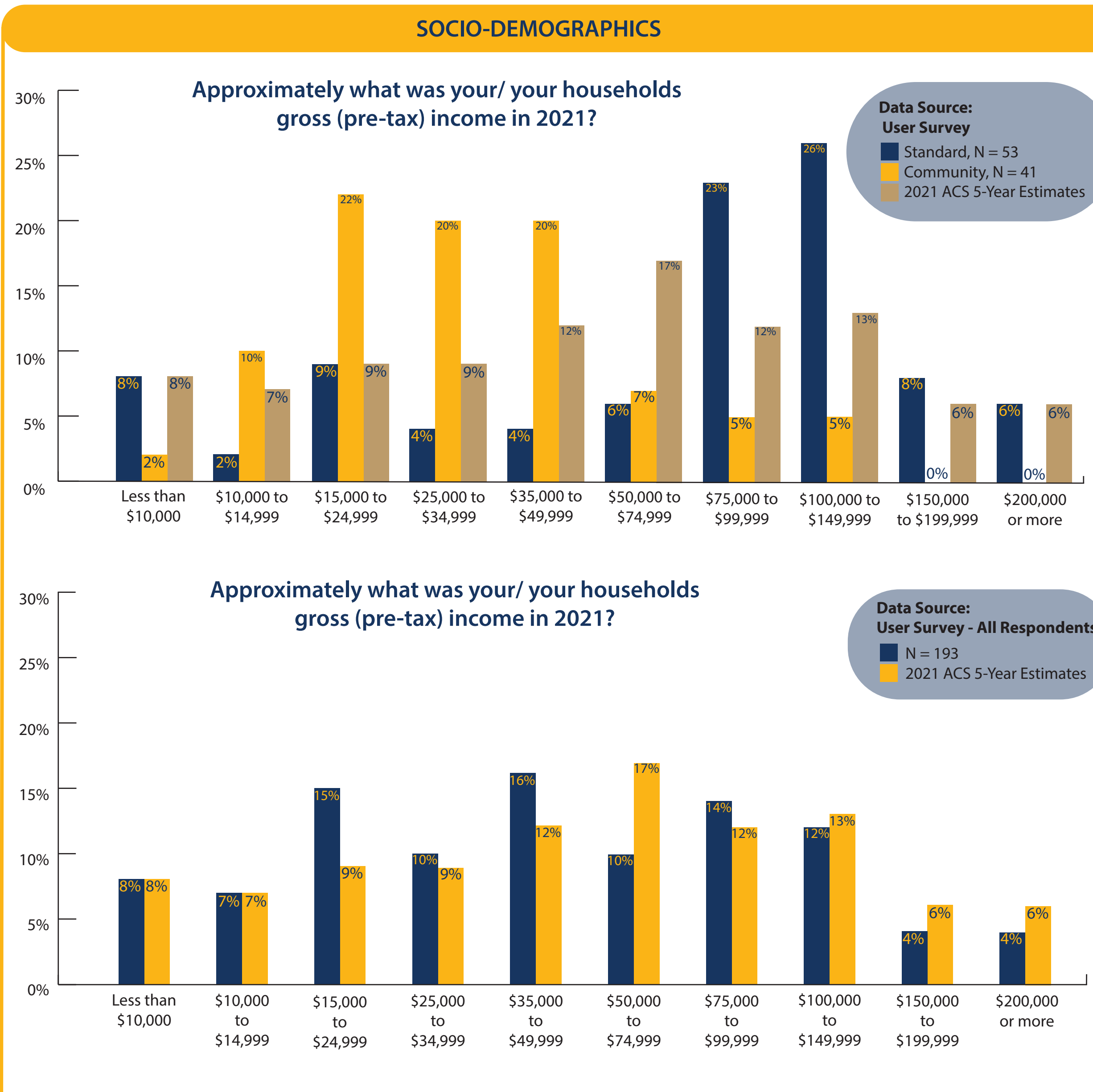**VMT:**
- Sum of all trip distances from the trip data

GHG Emissions:
- **Source:** Electricity generation for EV charging
- **Factors:** Efficiency-adjusted emission factors and time-variant power source intensities, measured in gram of CO_2-equivalent per kWh (gCO_2e/kWh)

Energy Consumed (kWh) = Onboard Charger Power Rating (kW) x Charging Duration (hour) (1)
GHG Emissions (gCO_2e) = Emission Factor (gCO_2e/kWh) x Energy Consumed (kWh) (2)

RESULTS

- 75% of both groups do not own or lease a vehicle.
- Community members generally have lower educational attainment and larger households than standard members.

SOCIO-DEMOGRAPHICS

Approximately what was your/ your households gross (pre-tax) income in 2021?
Data Source: User Survey — Standard, N = 53; Community, N = 41; 2021 ACS 5-Year Estimates

Approximately what was your/ your households gross (pre-tax) income in 2021?
Data Source: User Survey - All Respondents — N = 193; 2021 ACS 5-Year Estimates

FREQUENCY OF USE

*Note: categorical frequencies are mapped as approximations of numerical frequency levels observed in the trip activity data.
Data Source: Trip Activity Data — Standard, N = 1,931; Community, N = 1,143

OVERALL IMPACT

Share	Vehicle Shedding	Vehicle Suppression	Reduced Driving
	4%	30%	10%
Average VMT Reduction	4,186	6,319	1,632

- **Net VMT Reduction:** 463,845 miles
- **Net GHG Emissions Reduction:** 656 metric tons
- **Emissions Reduction due to fleet electrification:** 43%

$$GHG\ Emissions\ (gCO_2e) = \frac{VMT\ (miles) \times 8.89 \times 10^{-3}\ gCO_2/Gallon}{Fuel\ Economy\ (MPG) \times 0.993\ gCO_2/gCO_2e} \quad (3)$$

DISAGGREGATED IMPACTS

Member Type	YEAR	Vehicle Miles Traveled (VMT)			GHG (Metric Tons)		
		TOTAL SAVINGS	BLUELA DRIVING	NET IMPACT	TOTAL SAVINGS	BLUELA CHARGING	NET IMPACT
Standard	2021	588,000	407,000	-181,000	229	56	-173
	2022	417,000	594,000	+177,000	163	102	-61
	All Years	1,005,000	1,001,000	-4,000	392	158	-234
Community	2021	583,000	362,000	-221,000	227	51	-176
	2022	798,000	689,000	-109,000	312	117	-195
	All Years	1,381,000	1,051,000	-330,000	539	168	-371

Total Trips: N = 59,000 trips
- 49% by Standard members
- 51% by Community members

Total Users: N = 3,000 users
- 63% Standard members
- 37% Community members

ALTERNATIVE SCENARIOS

ICEV vs. EV FLEET
- If BlueLA had operated a hypothetical fleet of traditional gasoline vehicles, the total GHG emissions would have been 675 metric tons.
- Therefore using an EV fleet would reduce GHG emissions by 43% or 250

ABSENCE VS. PRESENCE OF BLUE LA

	Absence of BlueLA	Presence of BlueLA
Overall VMT	8,677,271	5,696,795
Overall GHG Emissions (metric tons)	3,389	1,751

- The presence of BlueLA resulted in an overall system reduction of 34% in VMT and 48% in GHG emissions.
- Due to the presence of BlueLA, 108 personal vehicles are shed and 910 personal vehicles are supressed.
- In other words, every BlueLA vehicle replaces 16 personal vehicles.

KEY INSIGHTS

1. In 2021, Standard members traveled a total of 407,000 miles and Community members traveled 362,000 miles using BlueLA vehicles.
2. In 2022, the total distances driven by Standard and Community members increased to 594,000 miles and 689,000 miles respectively, which can be attributed to the growth in the user base.
3. Specifically, among Standard members, 988 users were active in 2021 while 1,299 users were active in 2022. The split for Community members is 644 and 822 active users in 2021 and 2022 respectively.
4. The associated GHG emissions are computed based on the estimated charging of BlueLA's EVs using time-specific grid factors. For 2021, BlueLA charging resulted in 56 metric tons of GHG emissions for Standard members and 51 metric tons for Community members. These emissions rose in 2022, reaching 102 metric tons for Standard members and 117 metric tons for Community members, which can be attributed to the observed increase in VMT.
5. Using matched survey and activity data for 81 active users, we estimate weighted shares of 4% getting rid of a personal vehicle, 30% suppressing the purchase of a personal vehicle, and 10% reducing their personal vehicle driving due to BlueLA.
6. Overall, results show an estimated net reduction in VMT and GHG emissions of 463,845 miles and 656 metric tons respectively.
7. When disaggregating impacts by BlueLA member type, our findings show a net reduction in GHG emissions of 234 metric tons for Standard members and 371 metric tons for Community members.

ACKNOWLEDGEMENTS