EV SHARED-USE MOBILITY PROGRAM

A TRANSPORTATION ELECTRIFICATION CONCEPT

by

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ABOUT THIS CONCEPT SUMMARY

This concept summary is part of the Transportation Electrification Toolkit, designed to help Connecticut municipalities develop strategies to encourage transportation electrification through the pairing of electric vehicles and residential solar photovoltaic systems and electric shared-use mobility solutions. The toolkit consists of summaries of each transportation electrification concept, a case study of the concept from outside Connecticut, and potential approaches to deploy the concept for policymakers. The toolkit also consists of a resource library and interactive data dashboards that provide quick access to relevant information on transportation electrification in Connecticut.

The toolkit is a joint effort of Atlas Public Policy, Connecticut Green Bank, and the Connecticut Department of Energy and Environmental Protection.

In 2016, Atlas Public Policy began working with the Connecticut Green Bank and the Connecticut Department of Energy and Environmental Protection on the Green Bank's strategy to accelerate alternative fuel vehicle deployment in the state. Atlas began with a market potential assessment of various alternative fuels and vehicles tailored to local conditions in Connecticut. Atlas then identified promising electric mobility concepts, including electric vehicle shared-use mobility, the pairing of electric vehicles and residential solar, and high-powered electric vehicle charging infrastructure. Atlas evaluated the suitability of these concepts as part of a strategic planning process for the Connecticut Green Bank to help the Green Bank define its role in growing the alternative fuel vehicle market in the state.

CONCEPT SUMMARY

Shared-use mobility services (ride-hailing and carsharing) increase access to flexible, personal vehicle alternatives. With ride-hailing services, the user is a passenger in a hired vehicle, primarily for one-way trips. For carsharing, the user has access to a fleet of vehicles to drive for a one-way trip or roundtrip, depending on the service's business model [1].

Shared-use mobility programs that incorporate electric vehicles (EVs) into their operations can capture the economic and environmental value of EV technology. Public agency action in these programs can help overcome the barriers to the greater use of EVs for these uses, including raising upfront and operating capital and increasing demand for these services.

These programs can offer clean and affordable mobility solutions for underserved (low-income and low-mobility) communities, which is critical for three reasons. First, many low-income households have limited vehicle access potentially decreasing their mobility compared to other households. Second, low income communities are disproportionately affected by air pollution from vehicles [2]. Finally, affordable versions of these programs are crucial for connecting users with existing transportation hubs.

Using EVs in shared-use mobility services is already underway. For ride-hailing services, the company Evercar rented EVs to drivers of ride-hailing services such as Uber and Lyft in Los Angeles and San Francisco. For carsharing, the public-private partnership BlueIndy gives users access to a fleet of EVs and charging stations in Indianapolis. The Los Angeles EV Car Sharing Pilot will provide EV car sharing services to low-income communities in Los Angeles.

GOALS OF AN EV SHARED-USE MOBILITY PROGRAM

INCREASING ACCESS TO AFFORDABLE, FLEXIBLE, CLEAN MOBILITY SERVICES

Both carsharing and ride-hailing services can increase public access to clean, affordable mobility options. The deployment of a shared-use mobility service that uses electric vehicles (EVs) can expand access to clean transportation for residents of economically diverse regions in Connecticut. Shared-use mobility services can be used for trips best suited for personal vehicles, or in cases where public transit is not available. For example, studies have shown that ride-hailing complements current public transit options late at night when transit services are unavailable [3].

The primary purpose of carsharing and ride-hailing services are analogous; each service helps to increase the user's access to flexible and affordable mobility. The adoption of shared-use mobility services can reduce consumer costs associated with vehicle ownership, reduce vehicle emissions, and reduce traffic congestion [1]. For some consumers, shared-use mobility services can be an alternative to personal

vehicle ownership. Carsharing services reduces household vehicle ownership and regional emissions [4] [5].

REACHING UNDERSERVED COMMUNITIES

Improved transportation access creates economic opportunities for households in underserved communities, and access to vehicles for personal use improves employment outcomes [6]. Shared-use mobility services can help ensure that low-income residents with limited mobility options can access schools, jobs, grocery stores, and other frequent destinations. Services that use EVs can also improve the air quality in these communities [7].

Existing public transit routes do not always accommodate the transportation needs of households without access to a personal vehicle, leaving these neighborhoods underserved. In those communities, a flexible shared-use mobility program can help since they do not have the same time or route restrictions as typical public transit services [8]. These services can also connect users to transportation modes by offering first- or last-mile connections to transportation hubs including train stations, airports, and public transportation centers [9] [3]. For carsharing and ride-hailing, the price, infrastructure, and outreach of the service must be organized such that those in need are well-positioned to take advantage of a program.

EXPANDING THE EV MARKET IN CONNECTICUT

Greater EV adoption in Connecticut offers economic and environmental benefits at the local and state level. EV deployment is the most promising way to reduce emissions from the transportation sector in Connecticut. When considering current federal and state policies, EVs offer lifetime cost savings over gasoline vehicles resulting in more discretionary funds for drivers and potentially increased consumer spending. In addition, Connecticut has extensive local electricity generation capacity, which increases the likelihood that funds spent fueling with electricity will stay in the state's economy [7].

Through public-private partnerships, local governments can help stimulate new EV markets and expand existing markets by deploying EVs for shared-use mobility programs. Shared-use mobility programs that use EVs can amplify the environmental and economic benefits of fewer vehicles on the road. With fewer personal vehicles on the road, shared-use mobility programs can potentially lead to public savings in infrastructure and emission controls [1]. Successful deployment of shared-use mobility program with EVs can also increase exposure to the technology in underserved communities [10].

TARGET LOCATIONS IN CONNECTICUT

SELECTION CRITERIA FOR TARGET LOCATIONS

1. Improve access to mobility in urban and economically challenged areas: A ride-hail or car share program will need to improve local mobility options and increase access to EVs in communities that have above average shares of low income and low mobility households.

2. Leverage existing shared-use mobility services: The business case for using EVs in a shared-use mobility service could be improved by considering where similar services are being used throughout Connecticut. Specifically, the locations where the services are used, such as a university or train station, offer insight into a) where a shared-use mobility service might be successful, b) how a shared-use mobility service might complement other transportation options, and c) for carsharing, how the program's primary assets (vehicles and charging infrastructure) might be distributed.

3. Consider existing EV market development: The level of local EV market development (based on charging station availability and EV rebate usage) show where EVs are popular, as well as areas where adoption and infrastructure is lagging. For areas where EVs are more popular and existing infrastructure exists, a stronger business case may exist for a shared-use mobility service that uses EVs. On the other hand, in areas of low EV development, a shared-use mobility service could increase awareness and access to EVs and charging infrastructure.

Box 1. Shared-Use Mobility Dashboard

The Shared-Use Mobility Dashboard helps to show where shared-use mobility services may be viable in Connecticut. The first page of the dashboard is a high-level summary of the findings. Subsequent pages give greater detail on household income and mobility, the EV market in Connecticut, and current market distribution for the largest carsharing service in the nation, Zipcar, and ride-hailing service, Uber. The dashboard has data filters to show communities where there may be opportunities or need for a program based on population, mobility, and income demographics.
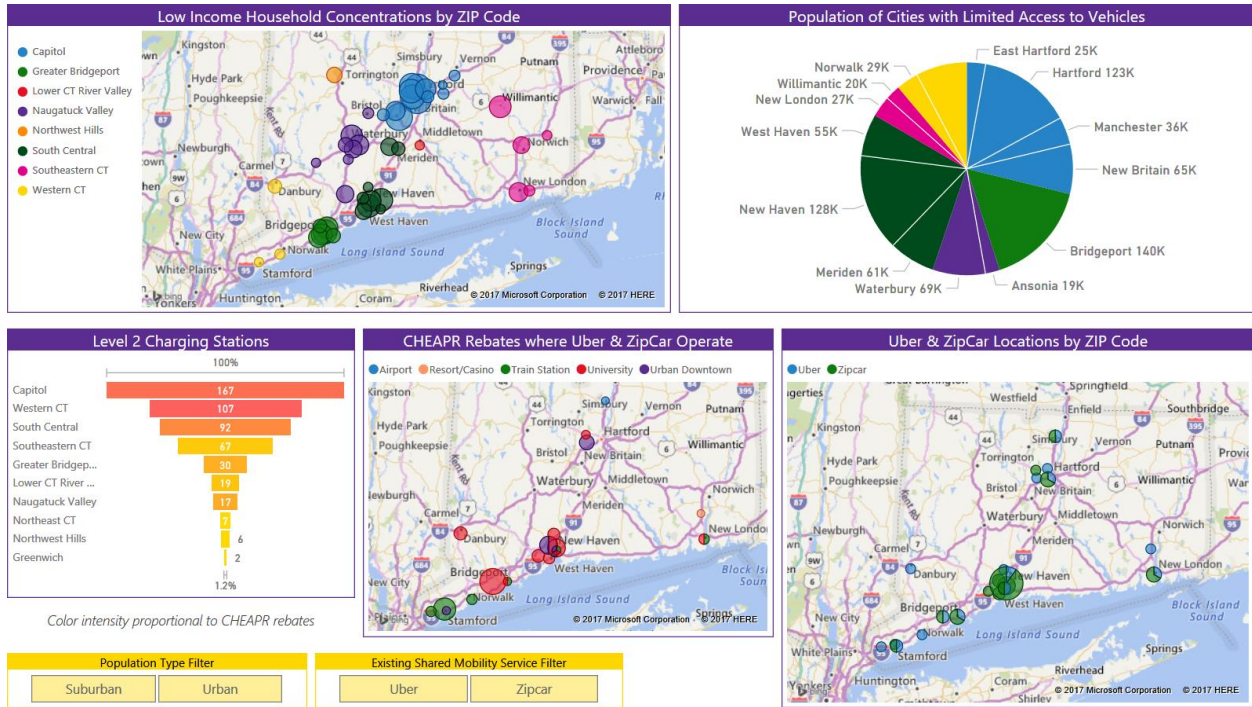
Below are definitions for the demographics data used to show target communities:

- Average population by ZIP code: 13,000 or greater
- Low Income by ZIP code: Households earning between $10,000 and $44,999
- Average share of low income households by ZIP code: 27.24%
- Low Mobility [Below average mobility by household]: Above average share of households with no vehicle, above average share of large households (4+) with no vehicle, and below average share of households with 2+ vehicles.
  - o Average share of households with no vehicle by ZIP code: 9.14%
  - o Average share of large households (4+) with no vehicle by ZIP code: 0.99%
- Average share of households with 2+ vehicles by ZIP code: 58%

Below are the data sources used in this concept summary.

- **Demographics:** data used in this concept summary is from the U.S. Census Bureau American Community Survey for 2015.
- **Shared-Use Mobility Services**: Atlas Public Policy collected data on shared-use mobility services in the fall of 2016.
- **Charging Stations**: Data was from the U.S. Department of Energy Alternative Fueling Station Locator as of the spring of 2017.
- **CHEAPR Rebates**: Data was from the Connecticut Department of Energy and Environmental Protection as of the fall of 2016.

SHARED-USE MOBILITY DASHBOARD

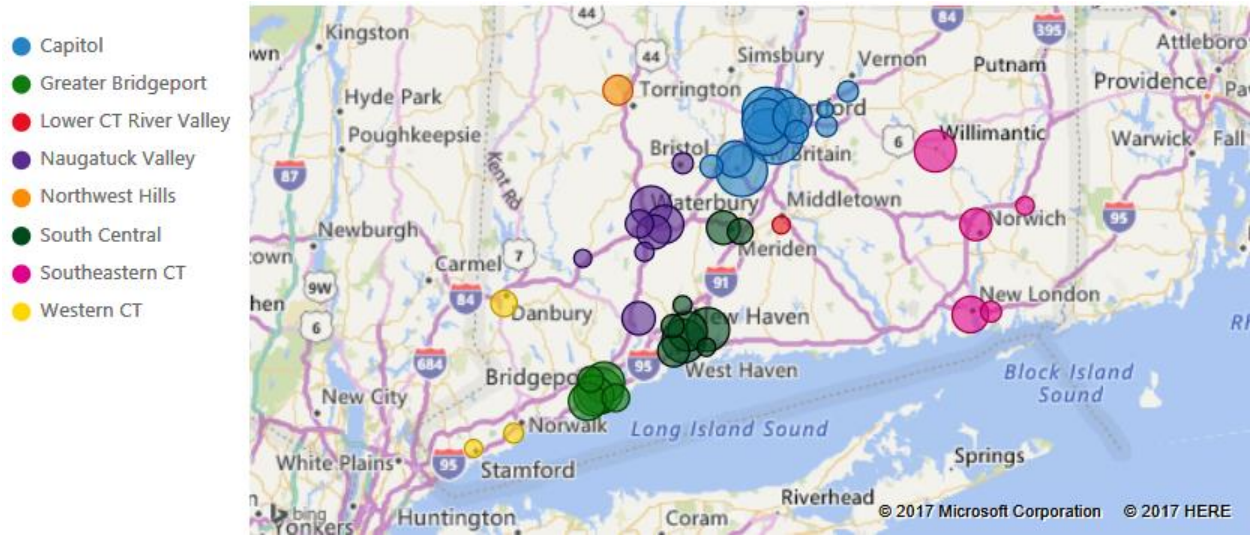*Source: http://atlaspolicy.com/rand/transportation-electrification-toolkit-for-connecticut*

UNDERSERVED COMMUNITIES IN CONNECTICUT

The following two maps from the Shared-Use Mobility Dashboard depict underserved communities in Connecticut (low income and low mobility). Figure 1 displays ZIP codes with above average share of low income households organized by planning region (Regional Councils of Government). The size of the bubbles is proportionate to the share of low income households. The map only shows ZIP codes where the share of low income households and the total population is greater than average. The pie chart in Figure 2 shows populations of cities where there is above average share of low income households and below average mobility. The colors correspond to the Regional Councils of Government planning regions from Figure 1.

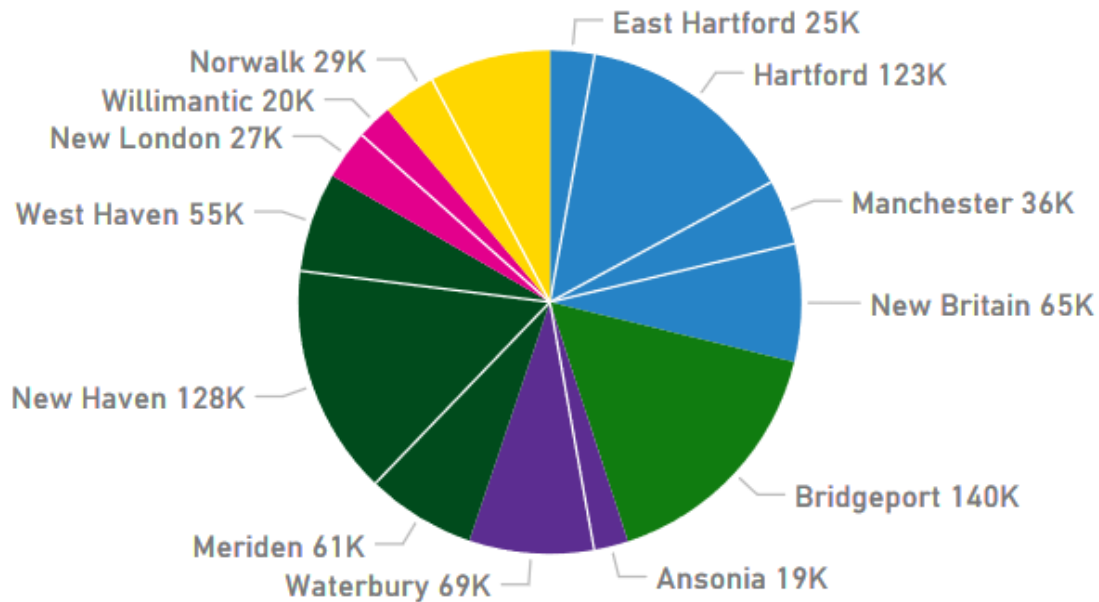ZIP codes with below-average mobility have:

- Above average share of low income households;
- Above average total population;
- Below average share of households with two or more vehicles;
- Above average share of households with no vehicles; and
- Above average share of large households (4+) with no vehicle.

FIGURE 1: LOW INCOME HOUSEHOLD CONCENTRATIONS BY ZIP CODE

Source: http://atlaspolicy.com/rand/transportation-electrification-toolkit-for-connecticut

FIGURE 2: POPULATION OF CITIES WITH LIMITED ACCESS TO VEHICLES

Source: http://atlaspolicy.com/rand/transportation-electrification-toolkit-for-connecticut

OPPORTUNITIES IN CONNECTICUT

KEY INSIGHTS

- As of 2016, Uber has hotspots in 16 communities and Zipcar operates in 10 communities, with overlap in 8 communities (half urban, half suburban).
- Uber and Zipcar operate primarily in (or near) ZIP codes in urban or suburban areas where there are above average concentrations of low income and low mobility households.
- Universities are the most popular locations for shared mobility services followed by train stations.
- Most of the EV charging stations in Connecticut are in suburban areas.

OPPORTUNITIES

- Deploying programs in suburban areas where there is a need for a shared-use mobility service can use existing infrastructure.
- Most Zipcar locations and vehicle assets are in New Haven around Yale University. A carsharing program that builds here could capitalize on the existing market and potential opportunities to reach underserved communities in the area.
- No Uber hotspots or Zipcar locations exist in Waterbury, a suburban community with a high population, high share of low income households, and low mobility suburban area. Though Uber operates in Waterbury, it does not consider the community to be a "hotspot." A program that emphasizes outreach to low income communities could be successful here given evidence of demand for shared-use services in demographically similar areas in Connecticut.
- In the highly-populated city of Bridgeport an opportunity exists to stimulate interest in EVs with a shared-use mobility program given the relative lack of EVs and charging infrastructure in the area. A program could be successful here given evidence of shared-use services in demographically similar areas in Connecticut.
- Danbury and New London are the only suburban areas that have both below average mobility and below average incomes as well as an Uber hotspot. A ride-hailing program servicing these areas could capitalize on an existing market to offer underserved communities in these areas with clean, flexible, and affordable mobility.

PROGRAM DEPLOYMENT CONSIDERATIONS

BARRIERS TO PROGRAM DEPLOYMENT

The social benefits of deploying EVs, setting up shared-use mobility programs, and increasing mobility access to underserved communities together give ample reasons to deploy a shared-use EV mobility program. That said, challenges exist to building competitive and sustainable markets for this type of

service, including raising upfront and operating capital, identifying and stimulating demand for shared-use mobility services, and reducing the risk of serving a population with reduced access to capital and credit.

Underserved communities need services that are either cost competitive with their current modes of transportation or offer a significant economic argument for regular use. A low-cost, fully-insured service for low-income users requires flexible and affordable membership options to ensure the viability and sustainability of the service.

Identifying and stimulating demand for shared-use mobility services requires a mixture of outreach and analysis. The previous section highlights areas where a program could be successful. Outreach to increase public awareness about the value of these services and of EV deployment can help stimulate demand from consumers and increase support for these services from public officials.

Deploying EVs and charging infrastructure is a more expensive proposition in the near term than deploying a program with gasoline vehicles. Public investment in infrastructure and vehicles, however, can reduce the fixed costs of deployment and in exchange capture the environmental and economic benefits of EVs over the life of the vehicle [7]. Local and state government measures can further reduce the costs of public parking for carsharing services, and can streamline the installation of publicly accessible charging stations [10]. This type of investment may require buy-in from transit agencies and local government and businesses [3].

CONSIDERATIONS FOR PROGRAM DEPLOYMENT

Figure 3 summaries the important issues carsharing or ride-hailing services must consider before deploying an EV-focused program, including outreach, membership and payment options, infrastructure, and insurance [10].

Table 2 and Table 3 in *Resource Library* the highlight considerable variation in the deployment of carsharing and ride-hailing business models based on location, market, and program goals. For example, some carsharing services have focused on low-income users and some have focused on EVs; several ride-hailing services allow riders to form impromptu carpools (also referred to as ride-splitting or ride-sharing), which can provide a low cost, flexible alternative to mass transit. Versions of these services could potentially be implemented in underserved communities.
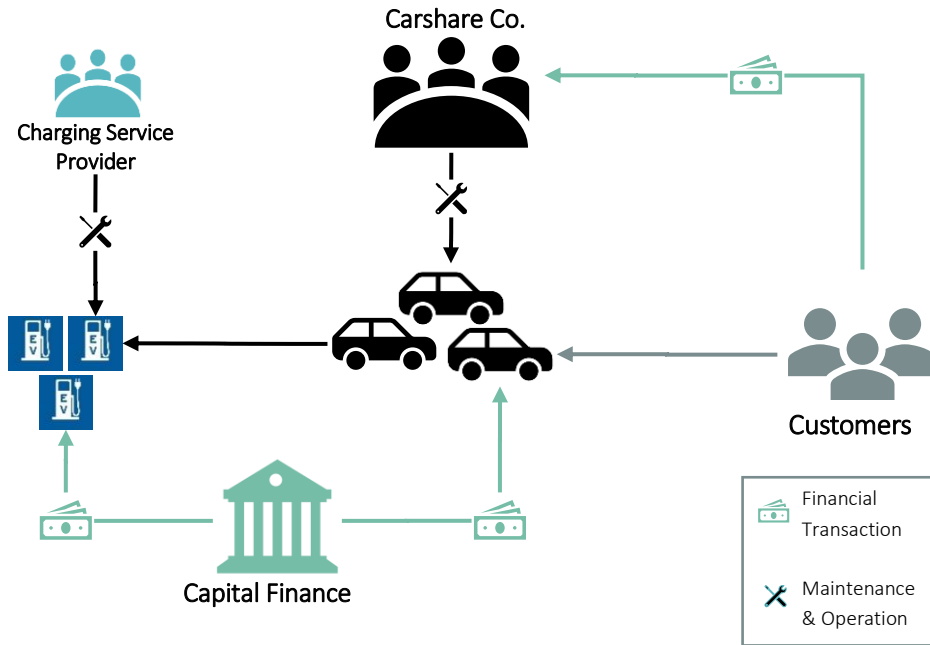
FIGURE 3: KEY CONSIDERATIONS FOR PROGRAM DEPLOYMENT

- **Procure financing from public and private sector partners**
  - Define upfront and operating capital requirements
    - Will the service provide a network of charging stations for driver use? If yes, what type of infrastructure should be used?
    - Will the service rely on peer-to-peer vehicles or will it purchase/lease vehicles?
    - What is the target membership/ fleet size?
    - Is the program a pilot or permanent?
  - Identify potential public and private investors
    - Can the state and/or local government quantify the environmental or economic benefits of the program to validate the use of public funds?
    - What private companies can provide funding?
    - Can non-monetary support be provided from public or private entities?
    - Is there support from local partners such as utilities, auto dealers, or commercial businesses?
    - Can taxi drivers be incorporated into the service?
  - Build support from public officials and address local challenges to deployment
    - Address zoning challenges related to vehicle parking and charging infrastructure installations.
    - Address challenges related to operating shared-use mobility businesses.
- **Identify and stimulate a market**
  - Identify community need and potential user demand
    - What is the potential market for a shared-use mobility program based on the location criteria?
    - What type of outreach will help pique interest and awareness about the program and EVs?
  - Identify accessible vehicle and charging locations
    - How will the service reach underserved communities?
    - Where should infrastructure be sited?
- **Address risk from reduced access to capital and credit for low income households**
  - Offer diverse and affordable membership options
    - How will the consumer pay for the service; how will the service be priced?
    - How will vehicles, drivers and/or passengers be insured?
    - Will users/ drivers pay for charging?

INTERVENTIONS IN A CARSHARING OR RIDE-HAILING BUSINESS

The following summarizes potential points of intervention in a carsharing or a ride-hailing business. These interventions can improve these business' financial performance, encourage the deployment of these services in low and moderate income communities, and draw interest from other private sector businesses that stand to gain from the greater deployment of these services.

FIGURE 4: TYPICAL CARSHARE BUSINESS STRUCTURE

Source: Atlas Public Policy

FIGURE 5: TYPICAL RIDE-HAIL BUSINESS STRUCTURE

Source: Atlas Public Policy

The carsharing business considered here is similar to BlueIndy, operated by Bolloré Group in Indianapolis. In this case, a single private company owns and operates the vehicles and the charging equipment. Vehicles in operation have dedicated parking spots, each accompanied with charging stations. The user experience is an A-to-B concept, where users do not have to return the vehicle to its original spot, but must only park vehicles in spots exclusively used by the carsharing business. Financial services are expected to be provided by a third party. Figure 4 summarizes the carsharing business.

The ride-hail business considered here is similar to Uber. In this case, a ride-hailing company provides a technology platform for user payment and access to a community of drivers. The company does not own and operate any equipment, including vehicles and charging stations. The drivers likely own the vehicles, but that is not a requirement. Third parties are expected to provide charging services and financial services. Figure 5 summarizes the ride-hailing business.

Public agencies and quasi-public institutions like green banks can intervene in these businesses through financial means or awareness building. The potential for financial interventions in both businesses are depicted by the green arrows in Figure 4 and Figure 5. Awareness building can be accomplished through direct stakeholder engagement, convening, and consumer education programs. Table 1 summarizes various interventions that green banks and state agencies could undertake to benefit an EV-based carsharing or ride-hailing business.

PROGRAM EVALUATION METRICS

EV shared-use mobility programs supported by state agencies or green banks could result in emission reductions and increased access to transportation services. The following are metrics that could be used in evaluating program success:

- **Gather Community and Stakeholder Feedback**: Conduct satisfaction and evaluation surveys of program participants and the general public in targeted communities. The surveys could gather feedback on the value of program elements, additional needs, and ideas for improvement.
- **Measure Use of Shared-use Mobility Services in Low and Moderate Income Communities**: Measure the use of EV carsharing and ride-hailing services in target communities. Comparing service use in target communities can improve the efficiency of resource allocation and highlight program successes and challenges.
- **Estimate Greenhouse Gas Mitigation Cost**: Estimate the cost of mitigating greenhouse gas emissions on a dollars-per-ton basis for different program elements. Elements could be weighed against each other to identify priority investments. These mitigation costs can be compared to other methods to reduce emissions from the transportation sector.

TABLE 1: POTENTIAL INTERVENTIONS IN A CARSHARING OR RIDE–HAILING BUSINESS

Intervention	Private Sector Target(s)	Public Sector Lead	Potential Elements	Expected Outcomes	Implementation Challenges
Low-cost finance for vehicles	3rd Party Finance, Carshare Co., Ind. Drivers	Green Bank	Require operation in low- or moderate-income communities; prioritize communities with high emissions.	Lower business operating costs; attract interest from companies with high finance costs.	Must have scale to be worthwhile; lack of interest from borrowers.
Grants or rebates for vehicles	Carshare Co., Ind. Drivers	State Agency	Require operation in low- or moderate-income communities; require payback if operating less than specified period.	Lower capital costs for business; improve costs of EVs versus conventional vehicles.	Achieving scale is very expensive; high cost to government without certainty.
User subsidy	Customers	State Agency	Limit to low-income families; substitutable for existing transit subsidies	Broader user participation; increased business interest in low-income communities	Distributing subsidy to large population; high operating costs.
Community advisory group	Carshare Co., Customers, Ride-Hail Co.	Green Bank	Dialogue with community on key program needs; develop and conduct awareness program.	Increased program awareness in targeted communities.	Holding attention of participants; achieving full community representation.
Outreach on EVs and incentives	Customers, Ind. Drivers	State Agency	Information dissemination; stakeholder convening.	Increased awareness of environmental and economic benefits of EVs.	Breaking through to individuals.
Electric utility engagement	Charging Service Provider, Carshare Co.	Green Bank	Make the case for benefits of EV mobility programs.	Increased interest in infrastructure investments.	Making shared-use mobility priority at utility.
Automaker and auto dealer engagement	Carshare Co., Ride-Hail Co., Auto Retailer Association	Green Bank	Make the case for benefits of EV mobility program.	Acceptance of shared use mobility as a way to increase EV sales.	Accurately estimating the potential sales; competing for attention with other EV-related programs.

Intervention	Private Sector Target(s)	Public Sector Lead	Potential Elements	Expected Outcomes	Implementation Challenges
Community engagement	Customers	Green Bank	Share benefits of EV shared-use mobility with low income and re-entry employment organizations as well as environmental and social justice groups.	Increased support for shared use mobility programs from key low incomes groups.	Contrasting EV shared-use mobility with other transportation modes.

RESOURCE LIBRARY

SHARED-USE MOBILITY SERVICES

The two tables below show select businesses operating in the carsharing and ride-sharing market. Businesses with links in the "Service" column are currently operating. Table 2 shows select carsharing services; some businesses are established and international, while others local and fledgling. Service offerings for each company vary depending on location. Businesses that have been acquired or have halted an EV program have been flagged.

Table 3 shows ride-hailing services currently available nationwide that operate through mobile phone applications.

TABLE 2: CARSHARING SERVICES THAT PROVIDE EVS AND/OR SERVICE TO LOW-INCOME COMMUNITIES

Service	Location	Status	EV	Low-Income	Description
Autolib'	Paris, France	Active	✓		All-electric service with approximately 4,000 vehicles and 6,100 charging stations. Owned by the Bolloré Group.
Bluecub	Bordeaux, France	Active	✓		All-electric service with approximately 200 vehicles and over 250 charging stations. Owned by the Bolloré Group.

Service	Location	Status	EV	Low-Income	Description
Bluecity	London, United Kingdom	Active	✓		All-electric service that will use 1,400 Bluepointlondon charging points. The program has faced contractual challenges in London that are delaying deployment. Owned by the Bolloré Group.
BlueIndy	Indianapolis, IN	Active	✓		All-electric service with approximately 240 vehicles and 80 charging stations with additional sites under construction. Owned by the Bolloré Group.
Bluely	Lyon, France	Active	✓		All-electric service with approximately 250 vehicles and over 500 charging stations. Owned by the Bolloré Group
BlueSG	Singapore	Not yet launched	✓		All-electric service that will be launched in 2017. Program will deploy 1,000 vehicles and 2,000 charging points by 2020. Owned by the Bolloré Group.
Bluetorino	Turin, Italy	Active	✓		All-electric service launched in 2016. Program will deploy 400 vehicles and 200 stations. Owned by the Bolloré Group.
Buffalo CarShare	Buffalo, NY	Defunct	✓	✓	Nonprofit service with 900 members acquired by Zipcar after it was dropped by its insurance carrier. Service targeted lower-income residents. Program trialed four EVs from 2013-2015.
Cambio CarSharing	Germany & Belgium	Active	✓		Service has 754 stations in 21 German and 34 Belgian cities. Over 2,200 vehicles are used by more than 79,600 customers. Electric mobility options introduced in 2011 are offered in multiple cities in both counties.
Capital Carshare	Albany, NY	Active		✓	Nonprofit service that does not charge application fees for students. Fleet has six cars and counting. Services' business plan offers that government grants provide opportunity to provide subsidized plans to underserved populations.
car2go	Select cities in North America & Europe	Active	✓		Internationally available service. Started an EV program in San Diego that it has since suspended. Car2go has EV programs in Stuttgart, Amsterdam, and Madrid. Owned by Daimler AG.
Carma	San Francisco, CA	Active	✓	✓	In 2015, Carma joined forces with City CarShare to bring total fleet size up to 400 cars. City CarShare is a nonprofit entity, providing

Service	Location	Status	EV	Low-Income	Description
(City CarShare)					public benefit services, including programs for low and moderate income families. Over half of the fleet is either a hybrid or all electric.
Cité Lib	Grenoble, France	Active	✓		Service run by Toyota provides ultra-compact Toyota i-Road and COMS vehicles through car-sharing management system Ha:mo.
Communauto	Quebec City & Montreal, Canada	Active	✓		Oldest car sharing company in North America. Service has been providing electric vehicles since 2011. Fleet consists of 550 electric and hybrid vehicles, of which 75 are all electric. It is the largest fleet of shared electric vehicles in Canada.
DriveNow	Select European Cities	Active	✓		A joint venture between BMW and Sixt providing over 4,000 vehicles. Electric vehicles are offered in nearly all cities. Copenhagen's 400 vehicle service is the only location to offer EVs exclusively. A service in San Francisco started as an EV carsharing pilot, but has since been suspended. ReachNow is BMW's latest rebranding and attempt to deploy carsharing in the United States. EVs are available through ReachNow in Seattle, WA and Portland, OR.
Enterprise CarShare	Select cities in North America & the United Kingdom	Active			Primarily targets mass markets, but is front and center in a slew of carsharing consolidations. Some of the companies that they have acquired provided EVs (e.g., WeCar), and others are nonprofit services that have provided services in underserved communities (e.g., iGo Car Sharing, Philly CarShare).
Evercar	Los Angeles and San Francisco	Defunct	✓		Provided over 100 EV car share for Uber and Lyft drivers until it suspended service in October 2016.
IBILEK	Basque Country, Spain	Defunct	✓		All electric car sharing service started in 2010 by the Basque Energy agency and Repsol. As of 2014 the company ceased providing service for its membership due to lack of use. It now solely provides service to corporations.
Los Angeles EV Car Sharing Pilot	Los Angeles, CA	Active	✓	✓	As part of the Charge Ahead California Initiative, LA received a $1.6M grant which leverages an additional estimated $8 million in in kind city resources and private operator investment in equipment and

Service	Location	Status	EV	Low-Income	Description
					operations to provide EV car sharing services to low-income communities in Los Angeles.
WaiveCar	Los Angeles, CA	Active	✓	✓	An ad-supported program that lets users rent from a fleet of 20 Chevy SparkEVs with two hours of free driving. The CEO is quoted as saying that the company is reaching "the lower-income people that need cars" by subsidizing with advertising.
Zipcar	Select cities internationally	Active	✓		The most prominent car sharing service in the United States and the only service operating in CT. The company has made a number of EV deployments in Chicago, Sacramento, Portland, and London (UK) to name a few. The company was acquired by Avis Budget Group in 2013.

TABLE 3: RIDE-HAILING MOBILE APPLICATION SERVICES IN THE UNITED STATES (2016)

Service	Service Area	Status	Taxis Available	Ride-splitting available	Description
Arro	New York City, Chicago, Boston, San Francisco	Active	✓		Mobile application that allows users to order a taxi cab ride or pay for a ride that they are already in.
Bridj	Washington, D.C., Boston, Kansas City	Active		✓	Pooled public transit alternative with limited drop off and pickup zones.
Curb	Select US cities	Active	✓		Taxi service available in over 60 U.S. cities.
Gett	New York City and select cities internationally	Active	✓		Black cab service.

Service	Service Area	Status	Taxis Available	Ride-splitting available	Description
Juno	New York City	Active			Business model hopes to attract drivers by hiring them full time rather than as contractors.
Lyft	Select cities internationally	Active		✓	Lyft operates in cities nationwide and in select international locations. Available in 14 cities in Connecticut as of October 2016. Lyft suspended operations in Fairfield, in 2015.
Split	Washington, D.C.	Active		✓	Exclusively pooled service in Washington, D.C. Split discontinued its service on October 3, 2016.
Uber	Select cities internationally	Active	✓	✓	Most prolific ride-hailing service, available in over 500 cities worldwide. Available in many parts of Connecticut. In Connecticut, a New Haven-based agency that provides workforce development programs for residents partnered with Uber to run a short-term pilot to provide free rides for transportation to employment interviews, jobs, or workforce training.
RideAustin	Austin, TX	Active			Non-profit community based service that was formed after Uber & Lyft left Austin. Company gives portions of profits to local charities.
Via	New York City	Active	✓		Taxi sharing service in New York.

REFERENCES

[1]   Shared-Use Mobility Center, "Shared-Use Mobility Toolkit for Cities," 2016. [Online]. Available: http://sharedusemobilitycenter.org/wp-content/uploads/2016/07/SUMC-Toolkit-Final-Report.pdf. [Accessed 27 September 2016].

[2]   M. Bell and K. Ebisu, "Environmental Inequality in Exposures to Airborne Particulate Matter Components in the United States," December 2012. [Online]. Available: http://ehp.niehs.nih.gov/wp-content/uploads/120/12/ehp.1205201.pdf. [Accessed 29 September 2016].

[3]   Shared-Use Mobility Center, "Shared Mobility and the Transformation of Public Transit," 2016. [Online]. Available: https://www.apta.com/resources/reportsandpublications/Documents/APTA-Shared-Mobility.pdf. [Accessed 27 September 2016].

[4]   E. Martin and S. Shaheen, "Greenhouse Gas Emission Impacts of Carsharing in North America," *IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION SYSTEMS,* vol. 12, no. 4, pp. 1074-1086, 2011.

[5]   E. Martin, S. Shaheen and J. Lidicker, "Impact of Carsharing on Household Vehicle Holdings: Results from North American Shared-Use Vehicle Survey," *Transportation Research Record: Journal of the Transportation Research Board,* vol. 2143, pp. 150-158, 2010.

[6]   The Urban Institute, "Driving to Opportunity: Understanding the Links among Transportation Access, Residential Outcomes, and Economic Opportunity for Housing Voucher Recipients," 2014.

[7]   N. Nigro and G. Morrison, "Moving Forward with Green Energy: Market Potential Assessment for Alternative Fuel Vehicles in Connecticut," September 2016. [Online]. Available: http://www.ctgreenbank.com/wp-content/uploads/2016/09/CTGreenBank-Market-Potential-Assessment-Alternative-Fuel-Vehicles-090816-FF.pdf. [Accessed 27 September 2016].

[8]   National Resource Network, "311 for Cities: Connecting Low-Income Residents with Transit Options," 11 September 2015. [Online]. Available: http://www.nationalresourcenetwork.org/en/Document/306222. [Accessed 29 September 2016].

[9]   National Center for Mobility Management, "Making First/Last Mile Connections to Transit," 2013. [Online]. Available: http://nationalcenterformobilitymanagement.org/wp-content/uploads/2013/11/Info-Brief-Shared-Use-and-Transit.pdf. [Accessed 27 September 2016].

[10] J. Espino and V. Truong, "Electric Carsharing in Underserved Communities," January 2015. [Online]. Available: http://greenlining.org/wp-content/uploads/2015/01/Electric-Carsharing-in-Underserved-Communities-spreads.pdf. [Accessed 27 September 2016].

[11] N. Nigro and G. Morrison, "Moving Forward with Green Energy: Market Potential Assessment for Alternative Fuel Vehicles in Connecticut," September 2016. [Online]. Available: http://www.ctgreenbank.com/wp-content/uploads/2016/09/CTGreenBank-Market-Potential-Assessment-Alternative-Fuel-Vehicles-090816-FF.pdf. [Accessed 11 October 2016].