



E-Bike Libraries Advance Mobility Options that Incorporate Equity and Climate Goals in Denver, Colorado

Challenge

The City of Denver is funding shared e-bike systems in neighborhoods with limited and unreliable transit access to advance its climate and equity goals. Voters created a local [\\$40 million per year Climate Protection Fund \(CPF\) financed by a .25 percent local sales tax](#) to fund climate initiatives, including a shared e-bike library in northeast Denver. The library lends e-bikes at no cost to low-income residents of two Latino neighborhoods, Globeville and Elyria-Swansea, providing a reliable, low-emission transportation option. Globeville and Elyria-Swansea residents have limited access to safe transportation and transit options. Since 2013, there have been four people killed in traffic incidents while biking or walking in the area and 22 more injured, though none were e-bike library users.¹ The historically industrial area is divided by a segment of I-70. [A public park was created in December 2022 over a portion of the highway.](#)

This shared e-bike program also advances climate goals. Colorado has set a target of [reducing emissions 26 percent from 2005 levels by 2025 and 50 percent by 2030](#), and Denver has a goal of reducing emissions [40 percent from 2019 levels by 2025 and 65 percent by 2030](#). To achieve this goal, the city must address the transportation sector, which is the [largest source of air pollution in Denver](#) and the second largest source of greenhouse gases. E-bike incentives are more cost-effective per dollar spent at reducing emissions than electric vehicle incentives, making them an attractive and efficient climate policy.² E-bikes also increase physical activity, improve physical and mental health, and encourage more trips outside of single occupancy vehicles. Denver already runs a [popular e-bike purchase rebate program for residents](#). The limited number of vouchers for \$300 off the cost of an e-bike and \$500 off the cost of an e-cargo bike [regularly run out within minutes of their release every month](#). Increasing private ownership of e-bikes is not the only way to increase e-bike trips. This case study examines shared use e-bikes as a method of addressing both sustainability and transportation equity priorities.

Notable E-Bike Initiatives in Colorado: Can Do Colorado Pilot Program

In 2020, the [Colorado Energy Office committed \\$500,000 to e-bike incentives](#) to provide new commuting options for essential workers making less than 60 percent of area median income. They launched a \$52,500 “mini-pilot” in 2020, with data support from Federal partners at the National Renewable Energy Laboratory (NREL). The program provided 13 eligible Denver residents with an e-bike, rider education, maintenance services and basic equipment, including a helmet, lock, and lights at no cost to the participant.

Program participants had positive opinions of the e-bikes and all reported riding at least three times per week. Users logged their trips by app and reported [that 28 percent of e-bike trips taken replaced car trips](#), and an NREL emissions analysis found that this pilot saved 1,367 pounds of CO₂. The mini-pilot was followed by a larger pilot in 2021, which deployed more e-bikes across different programs in the State.

¹ Denver Crash Data Dashboard <https://denvergov.org/Government/Citywide-Programs-and-Initiatives/Vision-Zero/Dashboard>

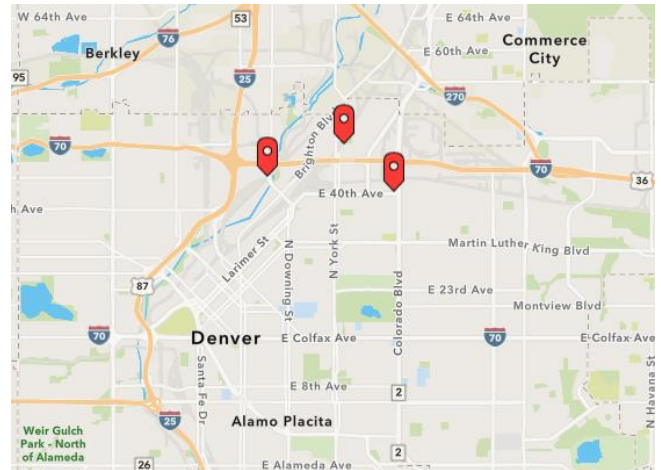
² Portland State University Transportation Research and Education Center, [Can Incentivizing E-bikes Support GHG Goals? Launching the New EV Incentive Cost and Impact Tool](#)



Solution

Based on the results of the Colorado Energy Office's Can Do Colorado pilot program, which provided e-bikes to low-income essential workers, the Denver Climate Action, Sustainability & Resiliency Office (CASR) funded [three e-bike libraries with \\$225,000 from the CPF](#). Spell out Climate Protection Fund here. [Northeast Transportation Connections](#) (NETC), a transportation management association, was awarded a three-year contract to operate and maintain the e-bike libraries.

NETC is an established organization, contracted by the State since 2017, to provide transportation demand management solutions for neighborhoods impacted by the Central 70 project. The highway project, which [received DOT support](#) from Build America Bureau and Congestion Mitigation and Air Quality funds, hired NETC to reconstruct and widen parts of I-70 in northeast Denver, mitigate community concerns about connectivity and provide alternative transportation solutions. NETC has also [operated a neighborhood bicycle library since 2012](#) and used the new CASR and CPF funding to expand the existing system with e-bikes and additional services. With the addition of Globeville and Elyria-Swansea, NETC manages a fleet of 30 e-bikes as well as 8-10 traditional bicycles available at three pickup sites, each one adjacent to a community partner organization. In addition to lending e-bikes for up to a week at a time, the library also provides a helmet, bike lock and battery charger to riders. NETC also offers rider support such as bike maintenance and bike safety training for new members, leading introductory rides in the neighborhood to help riders find safer and lower-stress routes, map out key locations like parks and grocery stores, and become more comfortable and confident traveling by bike.



NETC e-bike library locations in northeast Denver.
Image Source: CASR

How it Works

The bike library model allows riders to try out an e-bike without any financial or logistical commitments. For example, some library members live in transitional housing and cannot store an e-bike long-term, but they can still benefit from using one for shorter periods. NETC also regularly services the bikes as they come through the library so flat tires or other mechanical issues do not become persistent, unfixed problems.

During the COVID-19 pandemic, the library lengthened loan periods from 48 hours to a week and began providing charging equipment with longer-term e-bike loans. NETC also eliminated a requirement that members volunteer at the library for at least eight hours and waived a \$20 annual membership fee. The library continues to waive these fees for members referred by a partner organization as it continues to be a good strategy to encourage participation.

NETC works closely with other organizations that provide housing, education, health, employment and other community services in Globeville and Elyria-Swansea. The bike libraries are stationed inside shipping containers in the parking lots of three community partner organizations: the [Focus Points Family Resource Center](#), a social services hub; the Beloved Community Village, a transitional housing provider; and [Prodigy Coffeehouse](#), a nonprofit café operating workforce training programs. The program garnered interest and buy-in from their current partners because the e-bike library model is unobtrusive and flexible. The shipping



containers use solar-powered charging and are compact and self-sufficient. This reduces rent and utility costs, while also removing the pressure for program partners to provide these resources.

While two of the libraries are open by appointment, there are regular drop-in hours at the Prodigy location where people can apply for membership. The library requires previous biking experience and prioritizes low-income residents living in the 80216 ZIP code. The program goal is to provide people in the community with a reliable, low- emission transportation option at minimal to no cost.

A majority of library members are referred to NETC by a partner organization. Instead of advertising widely or recruiting potential members, NETC works closely with other neighborhood organizations to identify people who need transportation and are open to riding an e-bike. NETC's longtime presence in the community and the member referral system fosters a high level of trust and respect for the library among members. There have been no issues with e-bike theft or vandalism, which are often concerns for shared micromobility providers.



E-bike libraries are located in shipping containers with solar charging arrays. Image source: CASR



One of the e-bikes available through the library. Image Source: CASR

There is limited bike infrastructure in Globeville or Elyria-Swansea. When NETC first established the library, residents told them that “nobody bikes” on unsafe streets. Over time, Denver has worked to improve the bike network in the city and build out safer bike lanes. The completion of the Central 70 construction project significantly increased connectivity in Globeville and Elyria-Swansea. While there are still gaps and barriers, bike safety is improving. NETC provides wayfinding assistance and invitations to community rides in addition to the e-bikes. The goals are to introduce people to the routes in their neighborhood and get them comfortable cycling on the roads.

The library serves approximately 40 members, who rode a total of 18,922 miles during 2022, the first full year of the program. The library uses e-bikes from local manufacturer FattE-Bikes³ with an odometer that tracks

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Denver Worked to Expand E-Bike Access in 2022

In May 2022, the city council voted to approve \$830,000 for the Montbello Organizing Committee (MOC) to operate a [community electric shuttle and charging station and a solar powered e-bike library](#) with 10 bikes over the course of 3 years. NETC consulted with MOC on program logistics.

In September 2022, CASR [awarded a grant to Denver Food Rescue](#) to develop and implement a program to help people access and use shared e-bikes instead of vehicles for some trips.

total mileage as well as a GPS unit that gathers periodic location data over the course of an e-bike loan. Since the GPS units rely on a separate, dedicated battery that is only charged by NETC when e-bikes are returned, the GPS units conserve power by not tracking trip-level data such as speed, trip duration, origin-destination pairs, or route.

NETC staff engage regularly and directly with members at e-bike checkout and return identifying benefits to individuals as the most important performance metric. Many participants are longtime members who have used the library for multiple months. Members report that access to an e-bike has made a difference in their day-to-day lives as a convenient mode of transportation helping to access essential destinations. Almost all trips taken with the library's e-bikes are primarily for commuting and errands, not recreation. For example, one 16-year-old member used an e-bike to commute to work rather than riding with parents, freeing up the family car. Two library members moved out of transitional housing because they could rely on a no-cost e-bike commute to work.

Conclusion

E-bike libraries are becoming increasingly popular across the country as a way to provide access to affordable mobility and replace vehicle trips. E-bike sharing programs from [California](#) to [Massachusetts](#) are likely eligible for funding under several DOT [surface transportation funding programs](#). Allowable costs may include capital and equipment expenditures, education and encouragement activities related to safe access for bicyclists, and data collection and monitoring for bicyclists. NETC's e-bike library implementation in Denver highlights several key takeaways for practitioners considering developing similar programs elsewhere.

Consider tradeoffs with bicycle hardware selection – The library provides two models of e-bikes, a standard crossbar frame and a step-through frame that allows riders of different ages and abilities to more easily mount and dismount the bike. NETC is also considering expanding the fleet to include a cargo e-bike model to support additional utilitarian trips.

The library updated its loaner fleet from the initial offering after learning what bike equipment best served their riders for a better overall fleet composition. There were key elements of e-bikes that impacted user experience:

- **Rear Hub motor vs Mid-Drive motor** – It is easier for riders to change their own flat tires with a mid-drive motor instead of a rear hub motor that sits on the back wheel. NETC teaches fix-a-flat skills, but library staff had to handle all the maintenance for rear hub motor e-bikes in-house.
- **Throttle vs Pedal Assist** – NETC determined that throttle assist e-bikes posed an unnecessary risk for the program. NETC strongly recommends using a Class 1 pedal assist e-bike where the motor only provides additional power to the rider while they are pedaling.
- **Fat Tire vs Regular Tire** – Fat-tire bikes with 60–90 millimeter wheel rims are more stable, lower impact for riders and perform better in snow. NETC found that larger wheels are incompatible with front-loading bike racks on Denver's bus system. If participants need to connect to bus and transit, NETC recommends e-bikes with a narrower width wheel rim, such as the road bike range of 23-28 millimeters.



- **Battery Safety** – E-bikes that are being used by the community should always use UL-certified batteries and chargers from reputable manufacturers to mitigate the risk of lithium-ion battery fires. Providing safe hardware and charging is a simple step to ensure community safety and program trust and continuity.
- **GPS** – NETC currently uses a GPS system with a six-month battery life that connects to a Find My iPhone app, which allows for better accuracy for recovering bikes. The goal is to find a GPS that can charge directly from the e-bike battery and has a dashboard that can better record mileage and trip report data.
- **Parts Quality** – NETC found that higher-end components need fewer adjustments, less maintenance, and tune-ups over time so they create a safer ride and a more durable e-bike throughout the life of the program. Different bike companies use varying quality braking systems and drivetrain systems (brake levers, brake calipers, shifters, derailleurs, etc.). Since e-bikes are typically heavier than traditional bikes, NETC recommends hydraulic brakes for fleet applications.

Balance rider support and staffing needs – Hands-on support is important for building rapport with new members and getting them comfortable using an e-bike. Managing bicycle supply and operations across multiple locations and providing riders with safety training, route planning, and other assistance requires significant staff time. Establishing a new bike library or scaling an existing one means more staff may be needed to give members individualized attention. NETC originally hired a Bike Library Manager who worked 16 hours per week but found that it was not sufficient to keep up with participants and their e-bike maintenance needs. To relieve the burden this placed on other full-time NETC staff, the program used its CASR funding to bring the Bike Library Manager on full-time. With dedicated full-time staff working on the bike library, they hope to further improve and develop the program. There are many potential program elements an e-bike library could implement, depending on users' needs and the organization's capacity. Libraries could provide translation services for members, offer all-weather gear for year-round cycling, and collect information about poor road conditions from riders with damaged bikes to communicate maintenance needs to the jurisdiction's public works department.

Partnerships are key – Working with partner organizations is critical to identifying potential participants for the program and building trust in the community. NETC is exploring a potential fourth location and is considering partnering with a local for-profit restaurant that also serves as a community social hub in order to broaden its network in northeast Denver.

Additional FHWA Resources

- [Bicycle and Pedestrian Program](#)
- [Electric Bicycles \(E-Bikes\)](#)
- [Pedestrian and Bicycle Funding Opportunities](#)