Behavioral Changes for Energy Efficiency: an exploratory analysis of the CanBikeCO mini-pilot

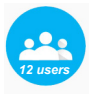
K. Shankari, PhD., National Renewable Energy Laboratory (NREL) k.shankari@nrel.gov
Andrew Duvall, PhD., National Renewable Energy Laboratory (NREL) andrew.duvall@nrel.gov

OpenPATH https://nrel.gov/openpath

This poster focuses on the evaluation of the CanBikeCO mini-pilot based on a dataset collected by a custom version of the OpenPATH platform. For an evaluation of the data collection process and lessons learned, please see our companion poster on Wed @ 10:30

Colorado Energy Office mini-pilot providing e-bikes to low-income workers

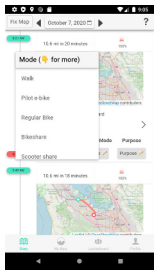
Participant photo courtesy Colorado Energy Office

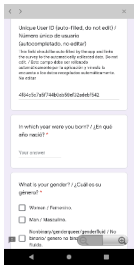


Motivation:
- ***Shared mobility health concerns***
- ***Pandemic cuts to transit service***
- ***Reduce shifts to single occupancy vehicles***

Objectives:
- ***Assist low-income essential workers***
- ***Improve mobility cost and productivity***
- ***Improve emissions, energy, and air quality***

Collected demographics and long-term travel diary





Energy and emission evaluation

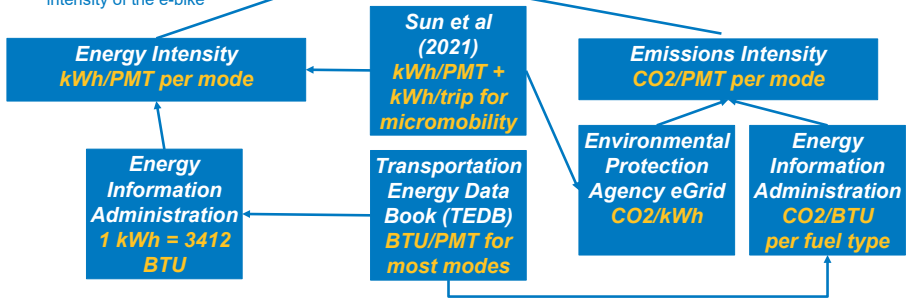
$EI_{replaced}$: energy/emissions intensity of the replaced mode

EI_{eBike}: energy/emissions intensity of the e-bike

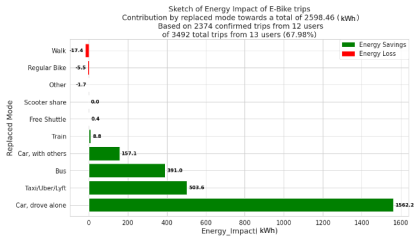
$$\left(EI_{replaced} - EI_{eBike}\right) * L_{trip} = EO$$

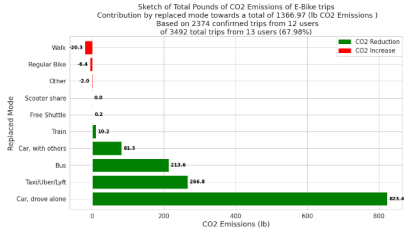
L_{trip}: length of trip

EO: Energy/emissions outcome



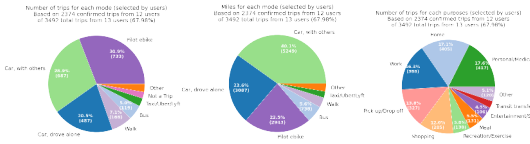
Energy and emissions impact

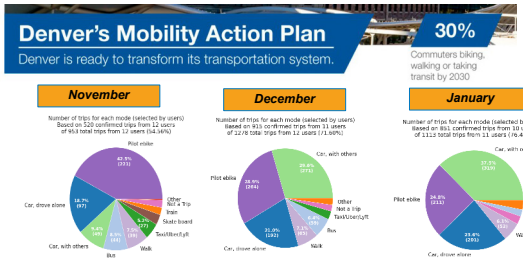


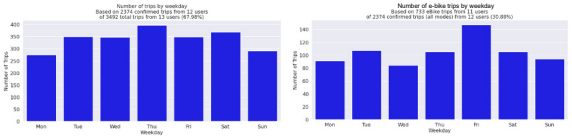


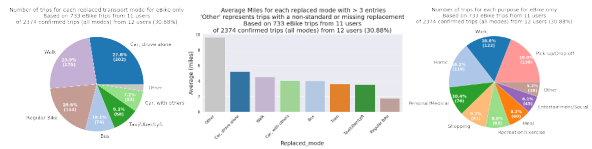
Sketch of the emissions and energy impact of the program, focusing on e-bike trips and their replacements. The bulk of the savings come from Single Occupancy Vehicle (SOV) replacements. The impact of e-bike use replacing walk and regular bike trips is negative, but the e-bike provides increased productivity (reduced travel time) in this case. The energy intensity of e-bikes is low, so the overall impact across all replaced modes is positive.

Basic statistics: trips, purpose, mileage, trends, comparison against goals









Trip count for all trips. E-bike was the dominant mode, and 'shared ride, not drove alone' was second. Mileage results are flipped, so e-bike trips were typically used for short trips. Trip purposes are typically home and work, as expected, but personal and pickup/drop-off made a surprisingly strong showing.

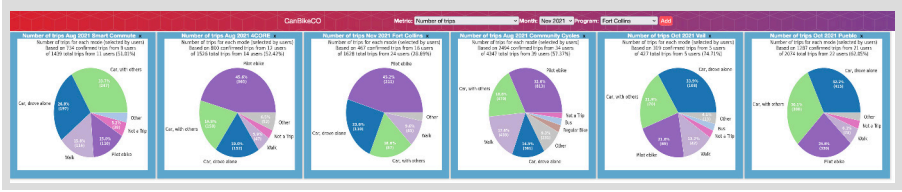
Participant travel patterns already exceed mobility mode share targets from 2030. E-bike mode share was an order of magnitude higher than the NHTS (1% in 2017). Participant size was small and demographically limited, so caution is warranted in extrapolating from these limited but very promising results.

Trends in mode share shifted over time. E-bike mode share dropped as the weather grew colder. But even in the height of winter in Colorado, the e-bike mode share was a respectable 25%. E-bike trips appeared to shift to shared ride instead of drive alone, thus in the direction of program goals.

Participants took roughly the same number of trips on weekdays and weekends. This pattern remained consistent for all trips and for e-bike trips in particular. E-bikes do appear to show a small peak on Fridays, which does not appear in the general data.

Continuing to focus on e-bike trips, the majority replace car drive alone trips, although walk and bike are close. E-bike use replacing walk/bike trips represent improved time benefits for users. Replaced drive alone trips are much longer than other modes. E-bikes are used for the full range of purposes, also meeting program goals.

Ongoing expansion to full pilot (~105 users, 6+ months, ~10k trips/mo)



https://dashboard.canbikeco.org

Conclusion

While the results are strongly positive, the small sample size, narrow demographic profile, and limited mobility alternatives for program participants indicate caution in broader interpretation. However, they do provide the tantalizing possibility that such programs can meet equity and sustainability goals simultaneously.

Data access for research

TSDC https://nrel.gov/tsdc

Demographics	Trajectory
Origin-destination	User Labels

Data access requires approval ONLY through secure portal

This work was authored by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. This work was supported in part by the Laboratory Directed Research and Development (LDRD) Program at NREL. This material is also based upon work supported by the U.S. Department of Energy, Vehicle Technologies Office, under the Systems and Modeling for Accelerated Research in Transportation Mobility Laboratory Consortium, an initiative of the Energy Efficient Mobility Systems Program. The views expressed in the article do not necessarily represent the views of the DOE or the U.S. Government. The U.S. Government retains and the publisher, by accepting the article for publication, acknowledges that the U.S. Government retains a nonexclusive, paid-up, irrevocable, worldwide license to publish or reproduce the published form of this work, or allow others to do so, for U.S. Government purposes.

Transportation Research Board Annual Meeting
Washington, DC
January 9–13, 2022
NREL/PO-5400-81839