What do we know about Electric Vehicles, cold weather and people from research in Alaska?

ACEP Alaska Center for Energy and Power
UAF University of Alaska Fairbanks
International Arctic Research Center
NSF #2318384 #2318385
UAA College of Engineering University of Alaska Anchorage
UAA Institute of Social and Economic Research University of Alaska Anchorage

NSF NNA Planning - Electric Vehicles in the Arctic

Goals

1. Identify perceived barriers to adoption, mechanisms for facilitating adoption, perceived usefulness, and potential uses of EVs.

2. Examine potential trade-offs between conventional and electric for rural vehicle users across specific use cases such as subsistence activities.

ACEP Alaska Center for Energy and Power
UAF University of Alaska Fairbanks
International Arctic Research Center
NSF #2127171 #2127172
UAA College of Engineering University of Alaska Anchorage
UAA Institute of Social and Economic Research University of Alaska Anchorage

Planning Phase: Community Workshops

Interviews and workshop in March 2022
- Interviewed between 8-10 organizations
- 8-14 participants in Bethel and Kɑtzebue, and Galena

Workshop in November 2022
- 5-9 participants in Bethel, Kɑtzebue, and Galena

Table at Cama-i festival in Bethel in March 2023 - ›80 visitors

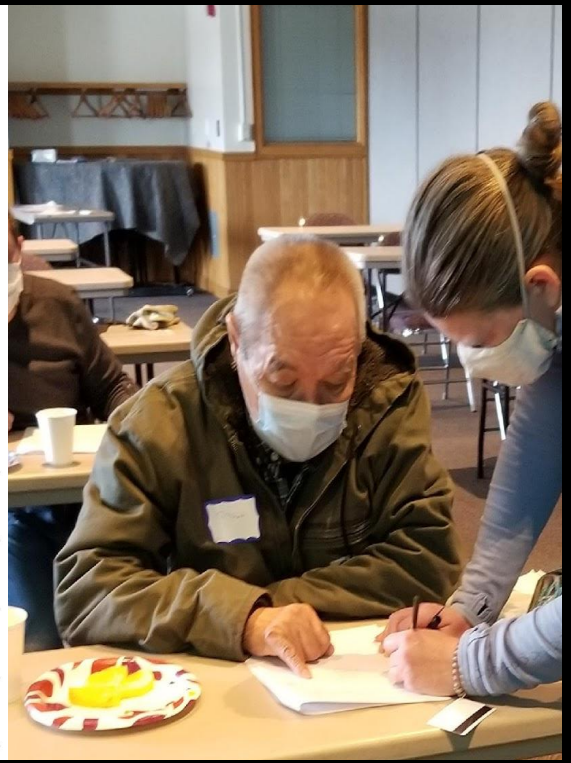
Max-Diff Exercise - first workshop

Please consider how important the different factors are when you consider purchasing an electric vehicle.

Considering only these 4 factors, which is the Most Important and which is the Least Important?

(1 of 8)

Select just **one most** important factor		Select just **one least** important factor
○	fear of breaking down	○
○	local ability to maintain vehicle	○
○	price	○
○	cold weather performance	○



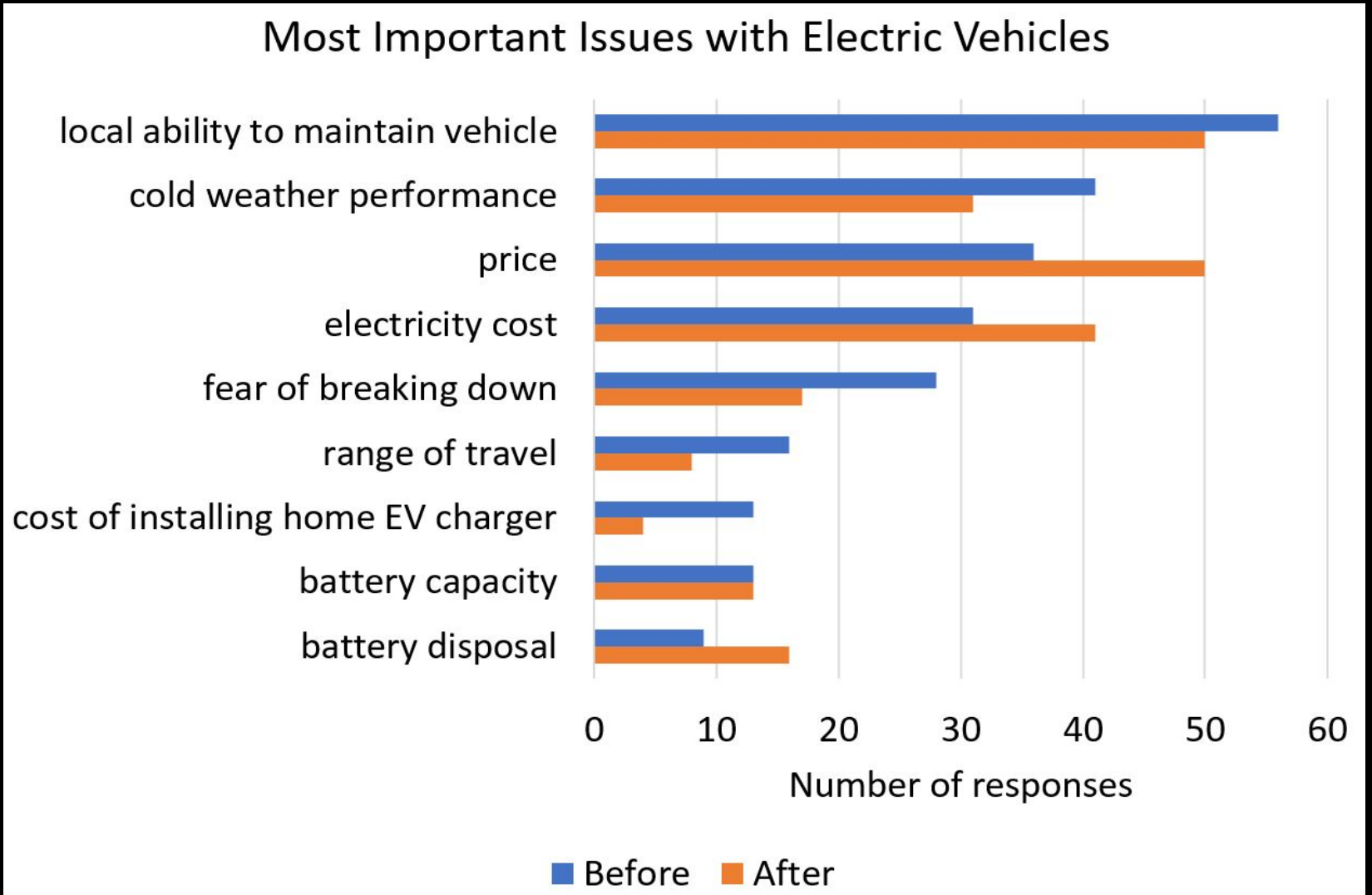
Barriers

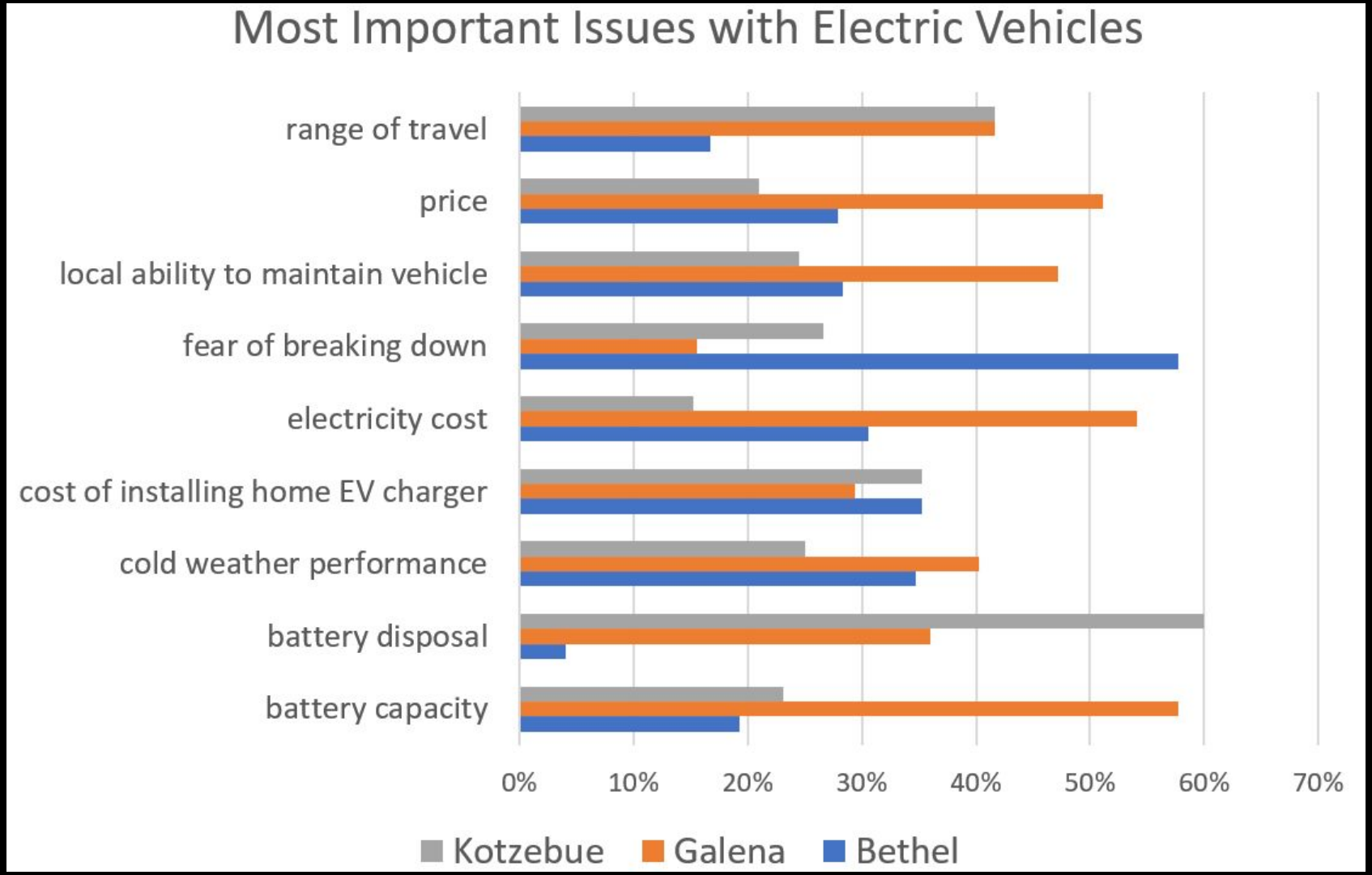
Included in Max-diff:

Price of vehicle
Cold weather performance
Range of travel
Battery capacity
Electricity cost
Local ability to maintain vehicle
Battery disposal
Cost of installing home EV charging
Fear of breaking down

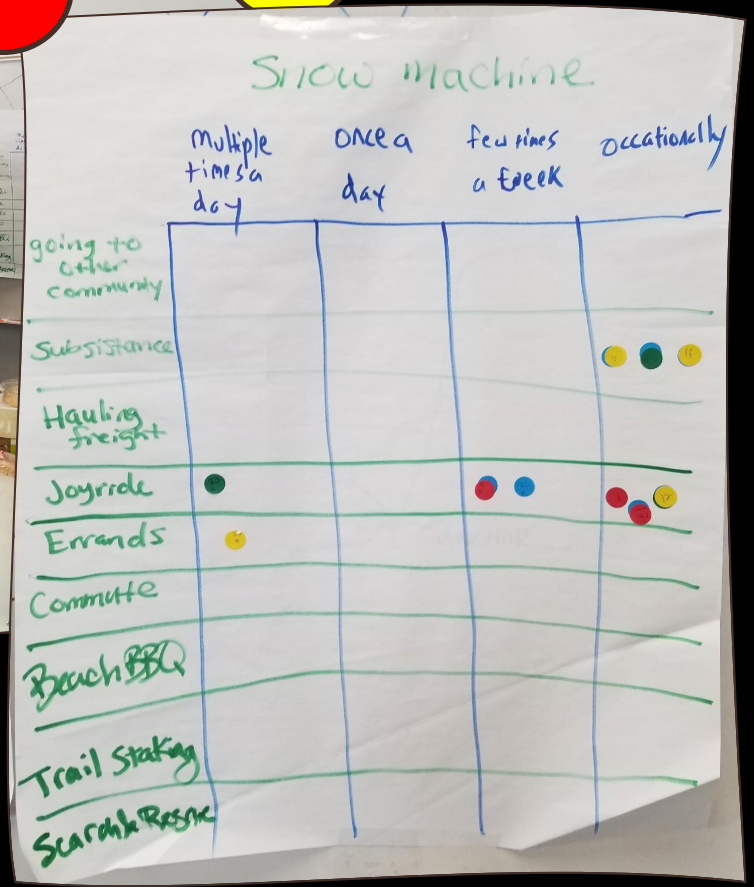
Identified by community members at the workshop:

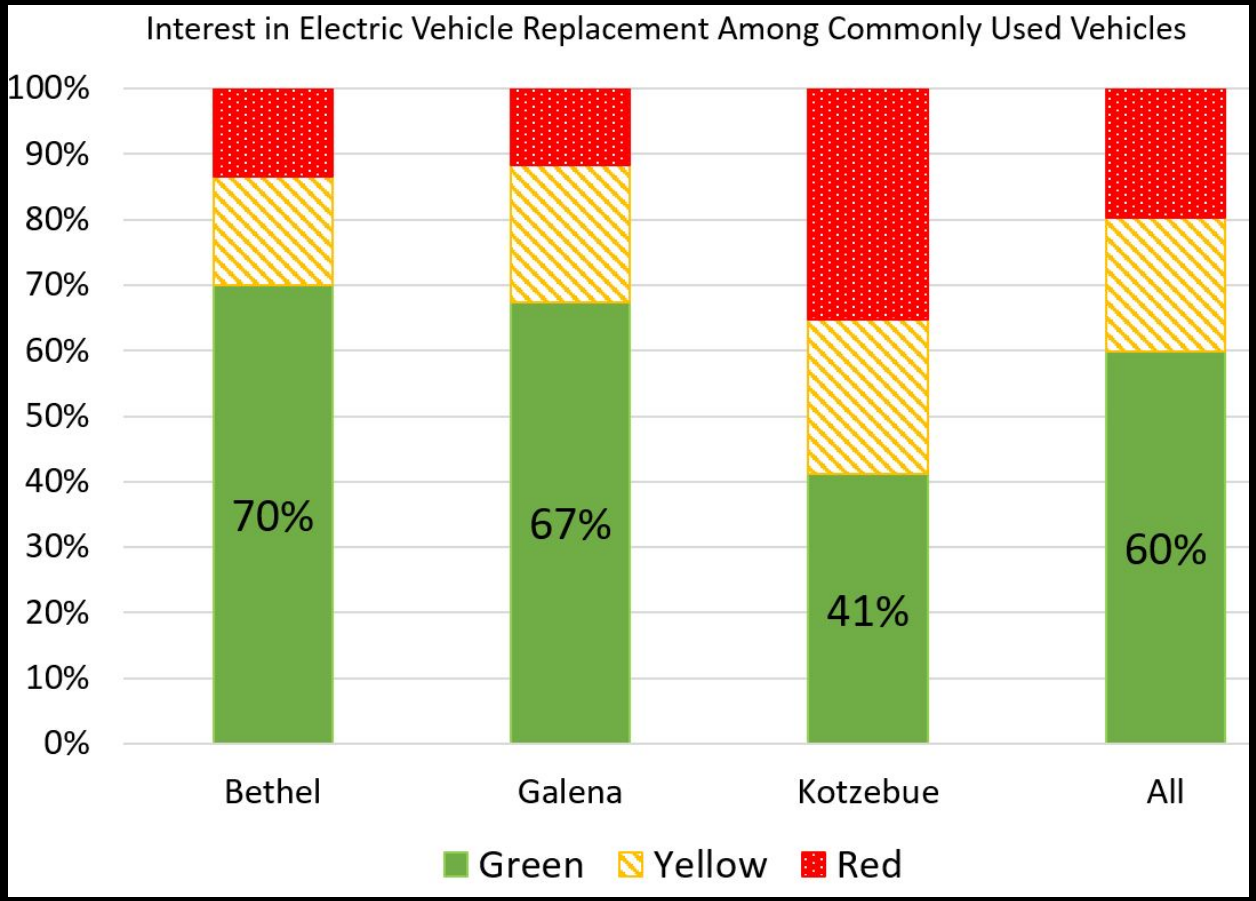
Resale value
Fragile
Cost of parts
Access to parts
Would like to see the EVs in action more (familiarity)
Heating
Cost of shipping
Part replacement
Weight
Frozen car batteries that cannot be brought back to life
Public places might not let you charge your vehicle
Vandalizing
Cost of insurance


Most Important Issues with Electric Vehicles
local ability to maintain vehicle
cold weather performance
price
electricity cost
fear of breaking down
range of travel
cost of installing home EV charger
battery capacity
battery disposal
0
10
20
30
40
50
60
Number of responses
Before
After


Most Important Issues with Electric Vehicles
range of travel
price
local ability to maintain vehicle
fear of breaking down
electricity cost
cost of installing home EV charger
cold weather performance
battery disposal
battery capacity
0%
10%
20%
30%
40%
50%
60%
70%
Kotzebue
Galena
Bethel

Vehicle Use – dots!!



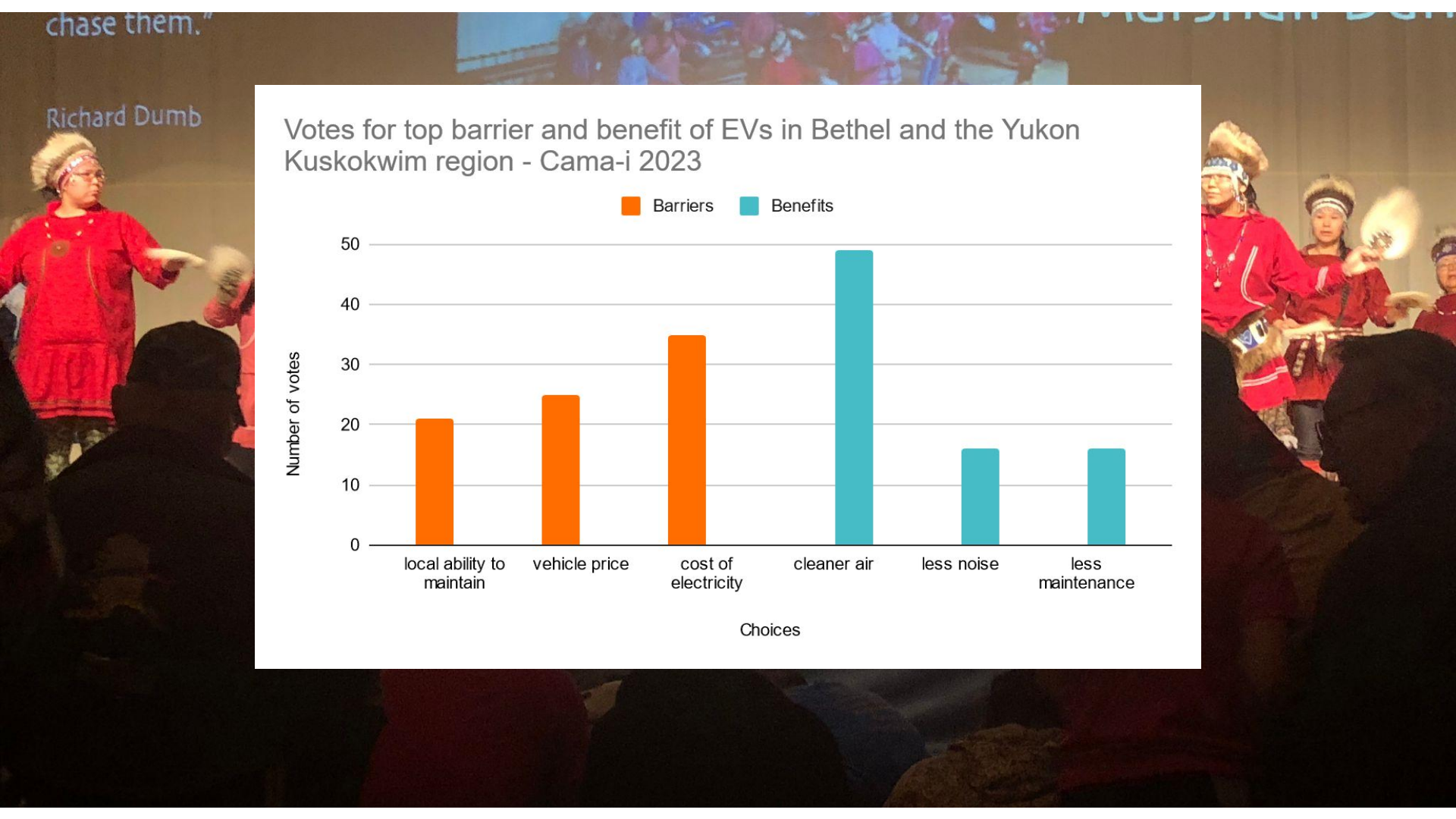


Workshops and bias?!?!

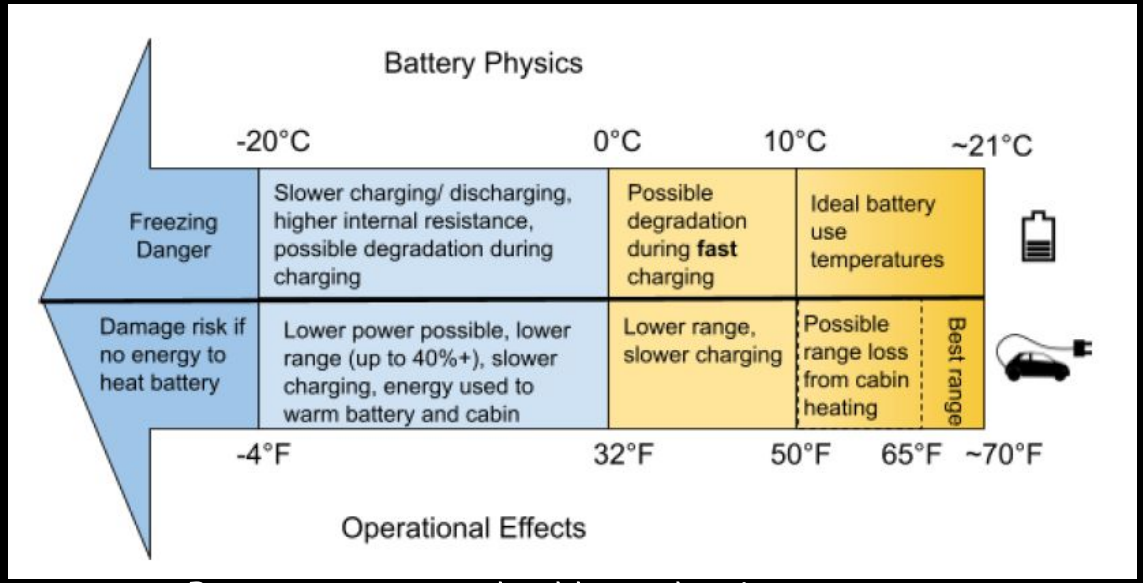
Opportunistic sampling
Household sampling
Online surveys

Benefits of EVs as identified by residents

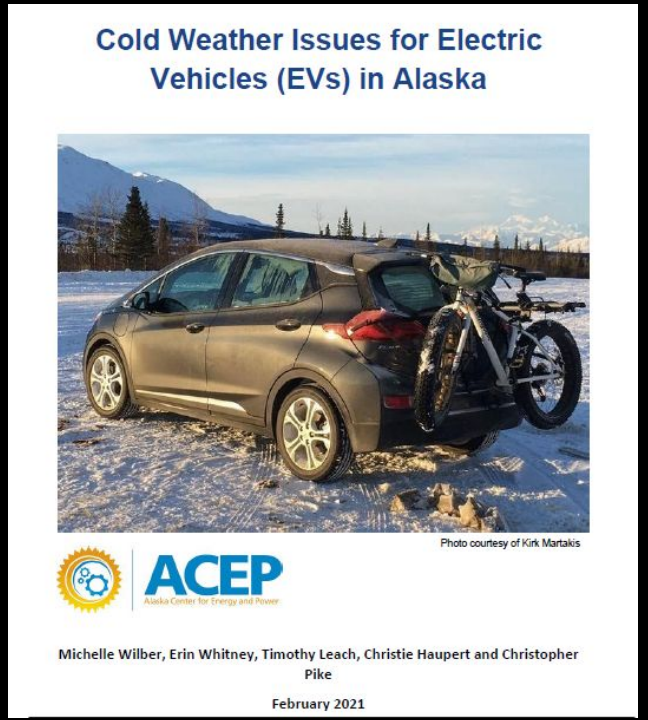
Benefits	Count	Percent
Cleaner town	10	30%
Lower fuel and maintenance costs	6	18%
Less noise	5	15%
Other (reliability, jobs, keep up with others)	5	15%
Lower dependence on fuel	3	9%
Less contribution to GG	2	6%
Less idling	2	6%
	33	


chase them."
Richard Dumb
Votes for top barrier and benefit of EVs in Bethel and the Yukon Kuskokwim region - Cama-i 2023
Barriers
Benefits
Number of votes
50
40
30
20
10
0
local ability to maintain
vehicle price
cost of electricity
cleaner air
less noise
less maintenance
Choices

Cold Weather Issues for EVs in Alaska

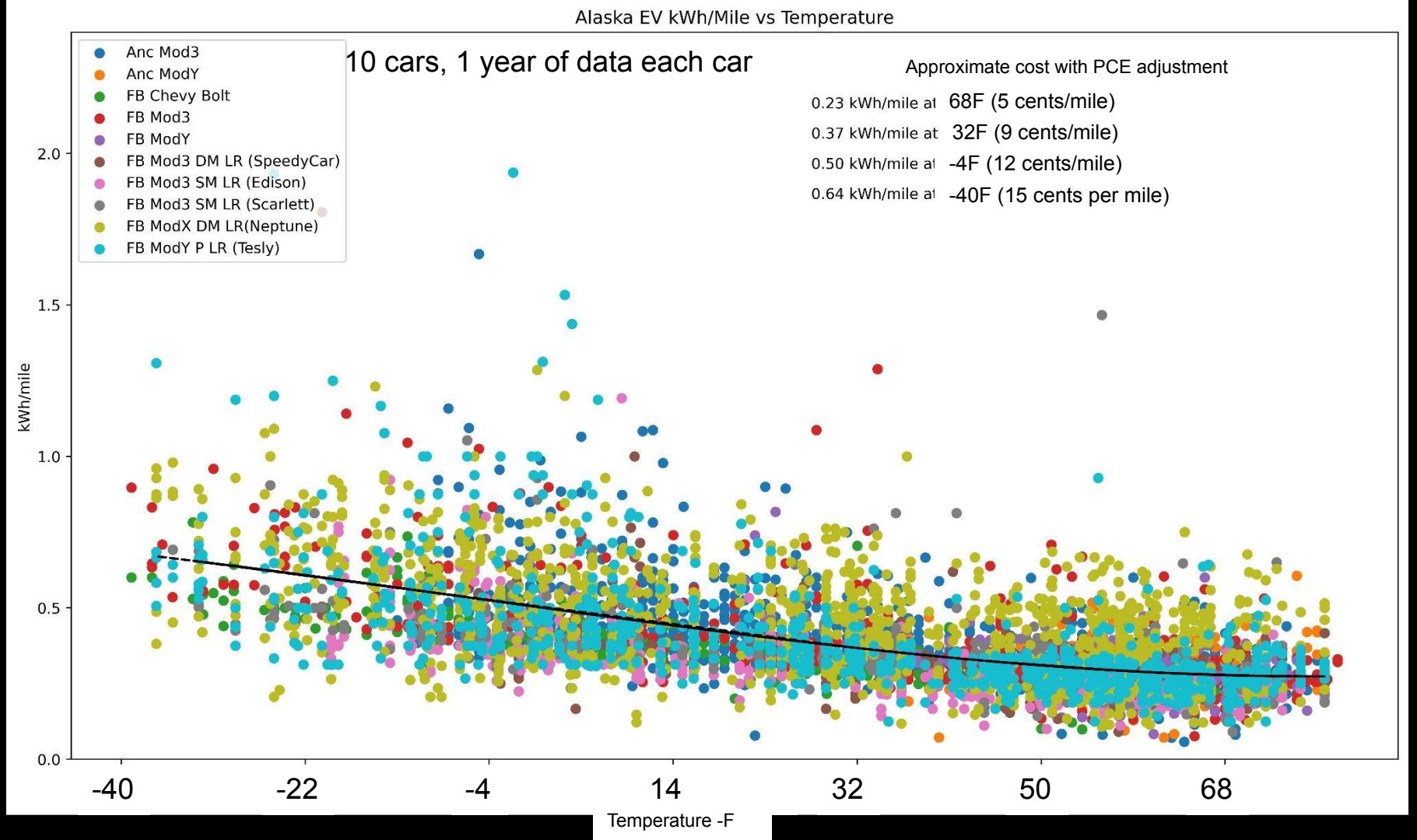


Report on expected cold weather impacts on EVs in Alaska based on literature review and experience of Alaska EV drivers.



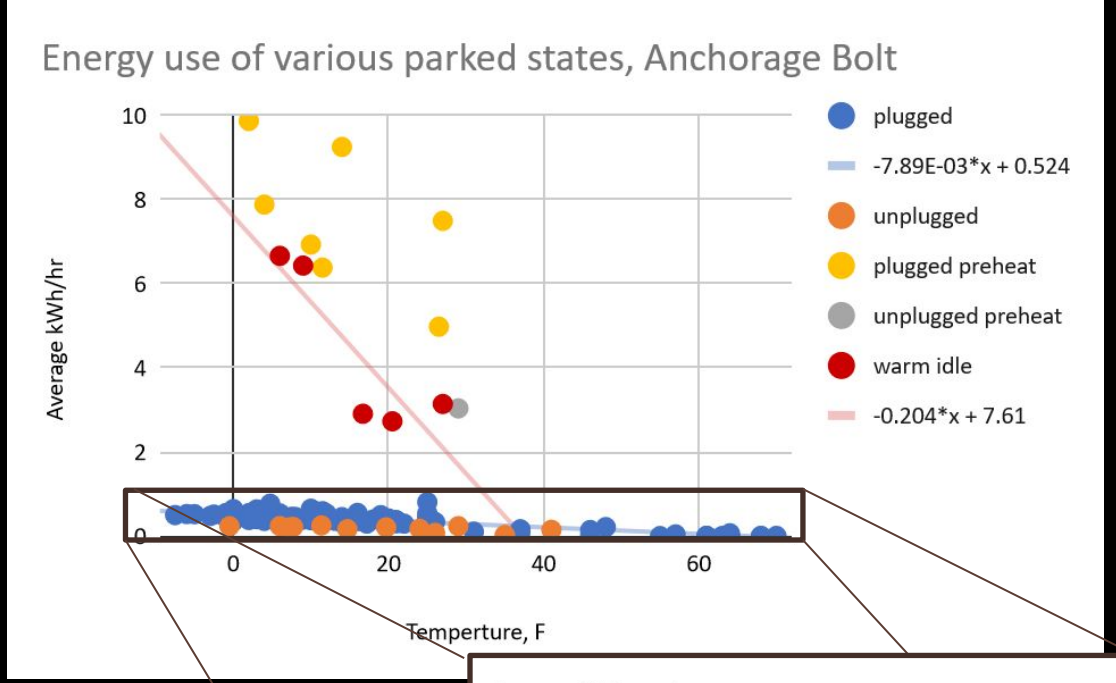
projects and reports at: https://acep.uaf.edu/projects-(collection)/bee.aspx

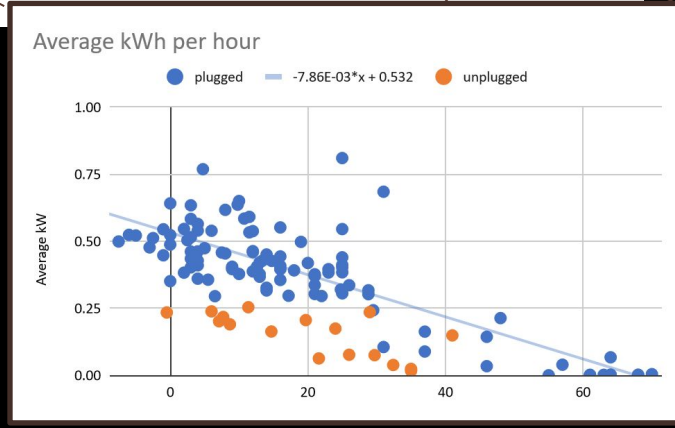
We’ve collected crowdsourced data from EVs in Alaska and used that to make a calculator to compare an EV to a gas vehicle


Alaska EV kWh/Mile vs Temperature
10 cars, 1 year of data each car
Anc Mod3
Anc ModY
FB Chevy Bolt
FB Mod3
FB ModY
FB Mod3 DM LR (SpeedyCar)
FB Mod3 SM LR (Edison)
FB Mod3 SM LR (Scarlett)
FB ModX DM LR(Neptune)
FB ModY P LR (Tesly)
Approximate cost with PCE adjustment
0.23 kWh/mile at 68F (5 cents/mile)
0.37 kWh/mile at 32F (9 cents/mile)
0.50 kWh/mile at -4F (12 cents/mile)
0.64 kWh/mile at -40F (15 cents per mile)
kWh/mile
0.0
0.5
1.0
1.5
2.0
-40
-22
-4
14
32
50
68
Temperature -F

Parked Energy Use

Data collection ongoing! Needed from more vehicle types in more temperatures.





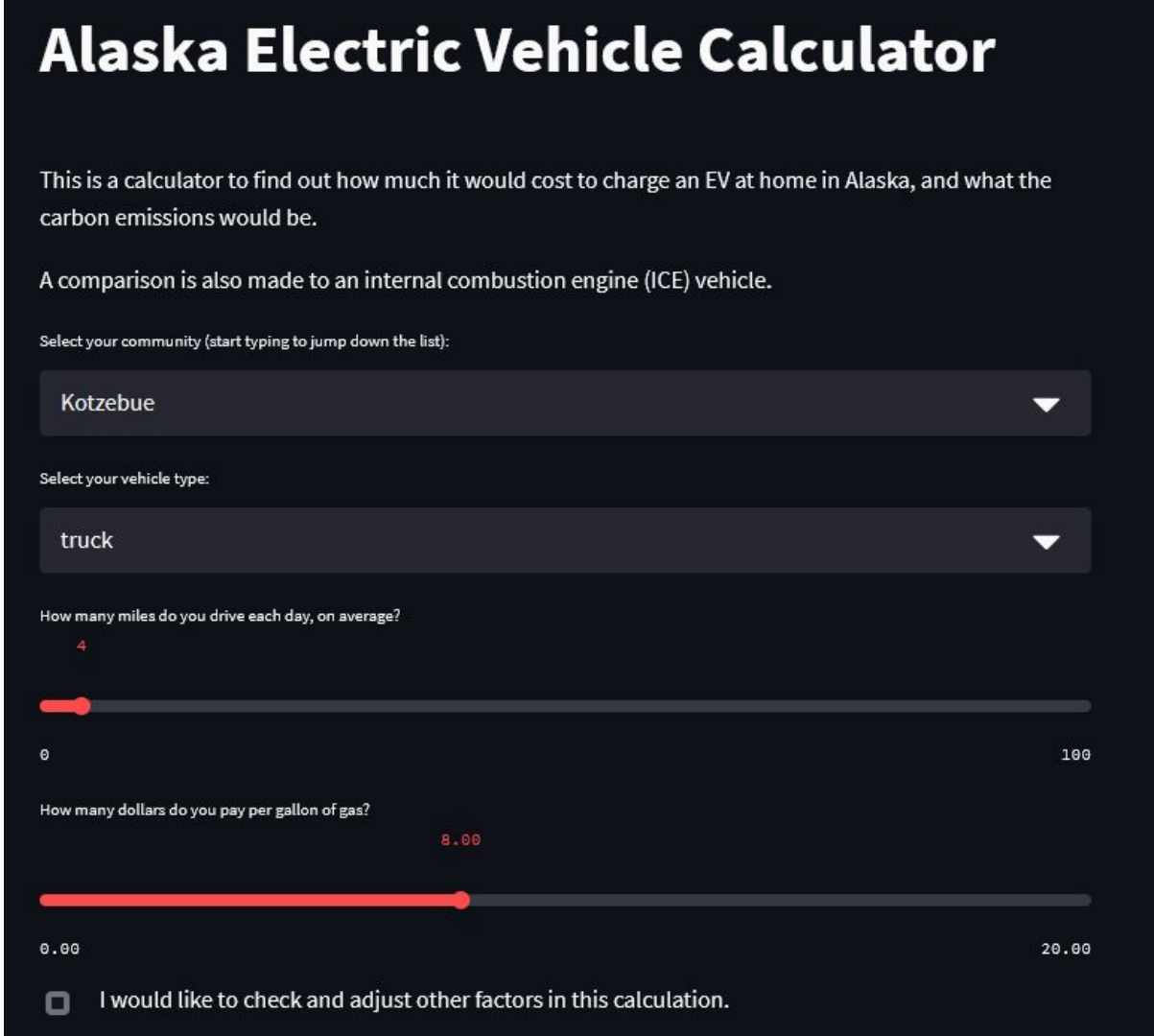
tinyurl.com/akevcalc

User Input

- Community
- Vehicle type
- Daily mileage
- Price of gas

Advanced:

- Utility info (rate/emissions)
- Vehicle efficiency
- Home solar
- Block heater use and idling for gas vehicle
- Garage/temperature
- Weekend mileage



Output

- Cost comparison
- Climate emissions comparison
- Monthly electricity use for EV

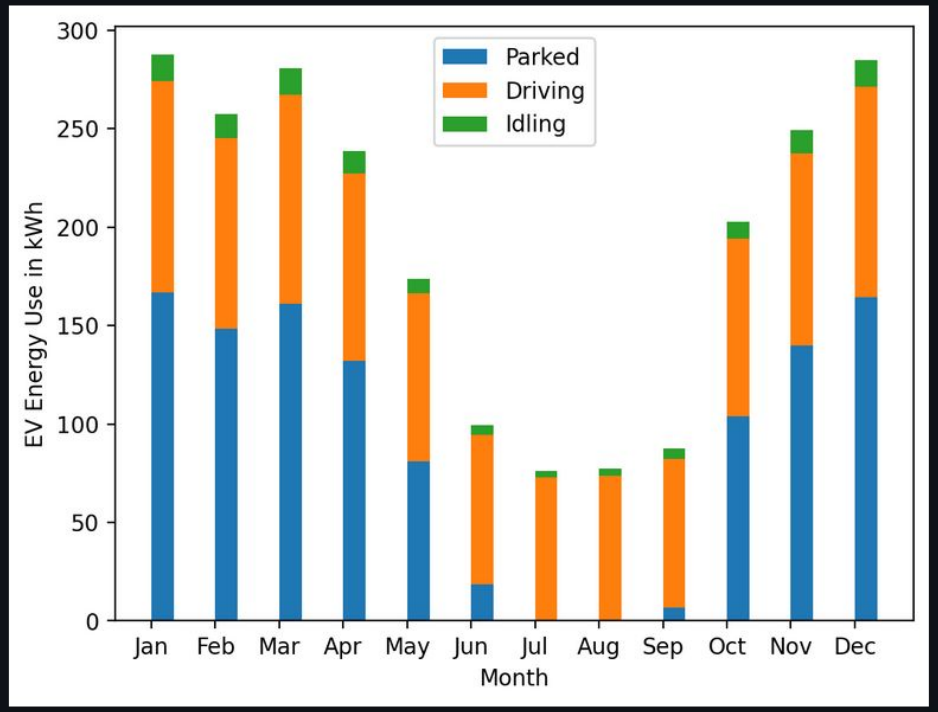
Total cost of Electric Vehicle fuel per year = $ `835.0`

Total cost of Internal Combustion Engine (gas) fuel per year = $ `824.0`

Total kg CO2 emissions of Electric Vehicle per year = `1546.0`

Total kg CO2 emissions of Internal Combustion Engine per year = `915.0`

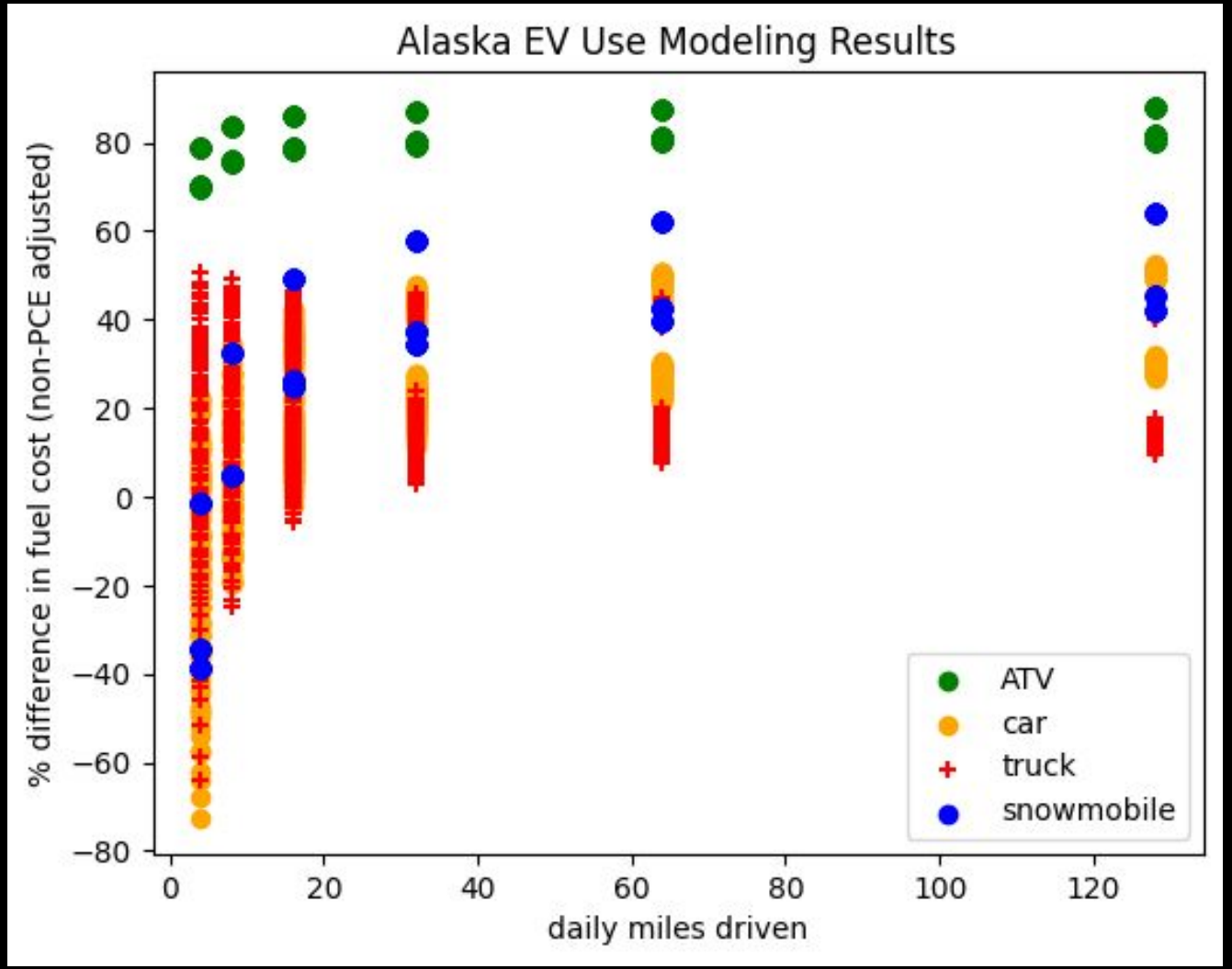
Note that costs and emissions for the Internal Combustion Engine vehicle include gas and any electricity used for block/oilpan/etc heating.



Based on Community Feedback:

Model being expanded to analyze other vehicles, seasonality

with vehicle use



Emissions of EVs go down with more renewables

Utility rates (e.g. PCE) can really affect the cost

Where do we go from here?

Follow-on NSF NNA Research Grant
Awarded with 5 year funding for:

-EV maintenance training for rural Alaska

-Electric off-road vehicle deployment and data collection

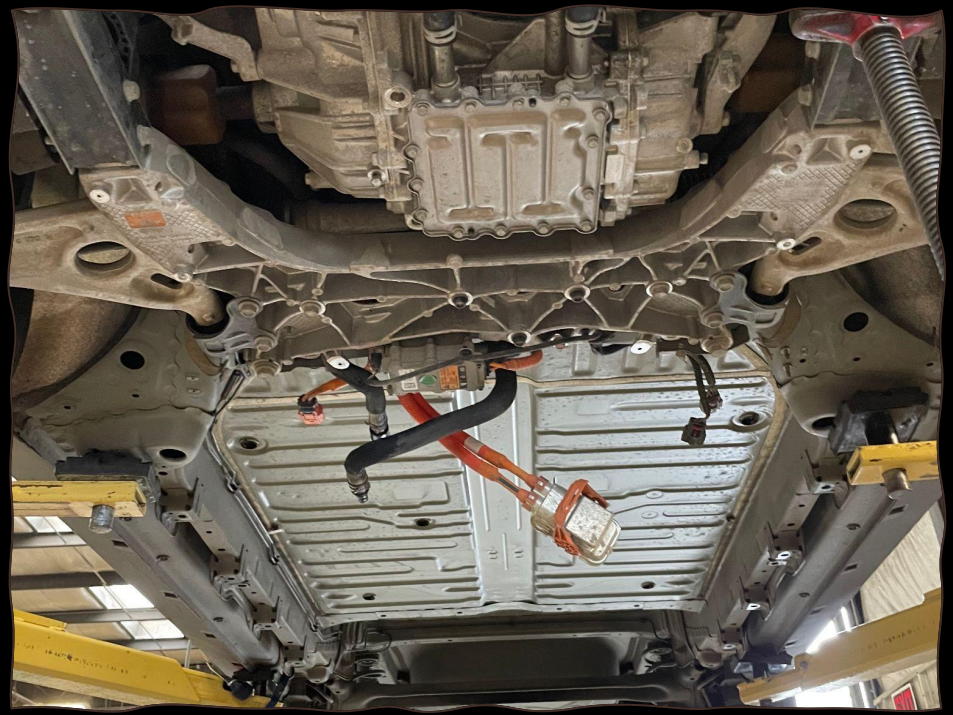
-More research on how EVs would work for rural Alaskans

#2318384
#2318385

EV Maintenance Training

-Working with ATC, Galena City School District, UAA Community and Technical College and others to develop an introductory training course for people in rural Alaska.

-This course will be taught once a year from 2025-2027.



Off-Road Vehicle Testing

Electric off-road vehicles (snow machines and ATVs) will be deployed in Kotzebue and Galena to gather data on how well they meet people's needs, and how they can work with the electrical grid.

How can we ensure that the energy transition benefits rural communities?

Questions?

Michelle Wilber
mmwilber@alaska.edu
Jennifer Schmidt
jischmidt@alaska.edu