Summer Road Trip August, 2024

Our summer vacation looped us east to Mt. Rushmore, south to Boulder, and northwest back to Bellingham. In preparation, I mapped out chargers for our electric vehicle (EV). At the start, charging stations in Washington were busy, with all bays occupied and cars waiting. One Rivian driver had crossed the country twice and warned that the Dakotas were where it was toughest to find EV chargers. In Montana, EV charging stations got farther apart, as did places to eat. We couldn't resist a series of billboard ads and had refreshing huckleberry shakes!

Charging at home or at work will typically meet everyday driving needs. Public fast charging stations support long distance travel. These are getting added rapidly and now number over 11,000. The plan is for designated fuel corridors to be serviced by fast chargers no more than 50 miles apart. I sought sites with multiple fast chargers, which were often in Walmart, Target, or grocery store parking lots. Our Kia EV6 took about 20 minutes to fast charge, convenient for snack and bathroom breaks. How long it takes to charge depends on available charging power and varies among EVs. My wish list for charging stations would include nearby amenities, solar panels or awnings for shade, trash bins, window squeegees, pull-through parking for EVs with rear charging sockets and EVs pulling trailers, and signage to locate the stations. All our stops felt safe, but reliability could be better; scattered non-functional chargers had connection errors, problems accepting payment, or non-responsive screens.

One driver told us he once let his EV's charge get down to 4%! (We never got close to that.) Did the way we drove affect mileage? We could extend our range by driving slower. At 80 mph, the speed limit in Montana and Wyoming, our dashboard miles/kWh reading was clearly less than at 40 or 50 mph in Nebraska. (Similarly, a gas-powered car gets better mileage at 55 mph than 80 mph.) Going uphill used more juice. Air conditioning had little effect, fortunately, since it was very hot, sometimes over 100°F.

As our trip progressed, we tried a lot of EV chargers, not all pre-plotted. One time an isolated road led to a little convenience store with a gas pump and 4 EV bays. I asked if they saw many EVs there. Actually, yes, they replied. Slower chargers at hotels allowed us to start "full" the next day. The Kia, via an adapter, hooked up to a Tesla charger at one hotel, but later couldn't connect to Tesla chargers in Mt. Rushmore's parking lot. The upcoming EV charging connector standard will enable EVs to charge at all charging stations (adapters may be needed initially).

We took advantage of free charging at Powder Hills Energy to lunch in Sundance, Wyoming. There was no extra fee for charging at an occasional hotel or pay parking lot. We paid mostly per kWh but pricing can be by subscription or per time period, and one car dealership set a $30 flat rate. When we're not traveling, our Kia gets to charge at home where electricity is much cheaper and offset by solar panels.

Mt. Rushmore, completed in 1941, was carved primarily using dynamite in just 14 years. In downtown Rapid City we saw life-size statues of nearly all the presidents. Badlands National Park strikingly juxtaposed strata of colored rock against green plains. We happily relaxed with friends in Boulder. We also visited the curious Termesphere Gallery, Minuteman Missiles, and museums for dinosaurs, mammoths, artist Clyfford Still, and nutcrackers. On the highway, we gaped at trucks carrying enormous wind turbine blades. Other trucks transported electric school buses west.

To utilize the sparse EV chargers between South Dakota and Colorado, our route wandered over to Scotts Bluff, Nebraska. A bit of the Oregon Trail there reminded me of hardships endured on journeys in times past. What a comfy ride we had, in our zippy, quiet, efficient EV! New EV models, improvements in batteries, and the expanding EV charger network will lead to more affordable and practical EV options; everyone should have the choice to make their next car a clean car. It was great to see the heartland, but also blissful to return home. Wishing you a happy summer!

RESOURCES ***(my comments in italics)***

EV sales: *Globally, 18% of cars sold were electric in 2023; EVs were 9% of cars in the US, 22% in the EU (93% in Norway), 38% in China. Because cars last a long time, the share of electric cars on the road is much lower than percent of new sales; this was about 2% in US, 4% in the EU (29% in Norway), 8% in China.* (https://ourworldindata.org/electric-car-sales). *In numbers, over 1.4 million electric vehicles (plug-in hybrids and battery EVs) were sold in the US in 2023. Over 5.5 million were sold from 2010 to the end of July 2024.* (https://www.anl.gov/esia/light-duty-electric-drive-vehicles-monthly-sales-updates)
EV range: *Most EVs go above 200 miles on a full charge, sufficient for a typical household's daily travel which averages approximately 50 miles.* (https://www.epa.gov/greenvehicles/electric-vehicle-myths #6).
EV charging stations:

- *Interactive map of Public Stations (select Electric for fuel) and Fuel Corridors. Click for graphed "Growth of EV Charging Infrastructure."* (https://driveelectric.gov/stations)
- *Upcoming EV charging connector standard* SAE J3400 (https://driveelectric.gov/charging-connector)
- *Tackling EV charger maintenance and repairs and training technicians:* (https://www.canarymedia.com/articles/ev-charging/ev-chargers-down-chargerhelp-is-training-a-diverse-workforce-to-fix-them)
- *Finding stations: PlugShare was more complete than Google or Apple Maps. The car dash displays charging stations, too. Lodging services (Booking, Hotels, TripAdvisor, Airbnb) let you filter for EV charger, but don't specify the charger type.*

Charging: *The EV's charging capacity, charger type and available charging power, and battery size and level all factor into how long it takes to charge*. These are the best electric cars for high-mileage US drivers. T Randall, Dec 2023 (https://www.bloomberg.com/news/articles/2023-12-14/these-are-the-best-electric-cars-for-high-mileage-us-drivers). *Charging rates drop at 80% to protect the battery as it gets closer to full. Some suggest charging partway at fast chargers rather than to 100% to save time and money, and ease queues.* Real-world study for the optimal charging of EVs. ED Kostopoulos et al, Nov 2020 (https://doi.org/10.1016/j.egyr.2019.12.008*). Another opinion:* Debunking the 80/20 limits on EV battery charging. B Gaton, Apr 2023 (https://thedriven.io/2023/04/04/debunking-the-80-20-limits-on-ev-battery-charging-more-fud-from-fossil-fuel-industry/)
Cost to drive: *It's cheaper to drive an electric car in every state if you charge it at home (buying electricity from the grid), which is the case ~80% of the time. This may not hold if you are relying on public fast chargers, because these can be 2-3 times more expensive.* The cost of driving a gasoline vs. an electric car across US states. H Ritchie, Jul 2024 (https://www.sustainabilitybynumbers.com/p/cost-gasoline-electric-us-states)
EVs reduce pollution: *Emissions over the lifetime of average medium-size battery EVs are lower than for comparable gasoline cars by 57-68% in the US.* G Bieker, Jul 2021 (https://theicct.org/publication/a-global-comparison-of-the-life-cycle-greenhouse-gas-emissions-of-combustion-engine-and-electric-passenger-cars/)**.** *Manufacturing an EV and battery generates more emissions than producing a gas car. Charging an EV will add emissions if the electricity comes from coal or natural gas, but this can lessen as low-carbon electricity increases. Internal combustion cars continue to pollute when driven, while EVs have no tailpipe emissions.* Electric cars are better for the climate than petrol or diesel, H Ritchie, Jan 2023 (https://www.sustainabilitybynumbers.com/p/ev-fossil-cars-climate)
Miscellaneous:

- Answering your questions about EVs, NPR Up First, Mar 2024. *Nice overview; listen or read.* (https://www.npr.org/transcripts/1198911299).
- *EV battery mining* (https://www.canarymedia.com/articles/batteries/an-optimists-guide-to-the-ev-battery-mining-challenge) J Spector, Jul 2024.
- EV fire FAQs (https://www.evfiresafe.com/ev-fire-faqs).

Scotts Bluff: *Enjoy these William Henry Jackson paintings of the road through Scotts Bluff!* (https://nps.gov/articles/000/road-through-scotts-bluff.htm)