COMMENT

EV INCENTIVE POLICIES SHOULD TARGET REDUCING GASOLINE USE

by Matthew Metz and Janelle London

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The United States uses more gasoline than any other nation.[1] Gasoline is the source of 17% of U.S. carbon emissions.[2] To achieve emissions reductions consistent with the 2030 goals set by the Joseph Biden Administration[3] and the Intergovernmental Panel on Climate Change (IPCC),[4] annual U.S. gasoline use by light-duty vehicles will need to decline by 67%, or 96 billion gallons, in the next eight years.[5]

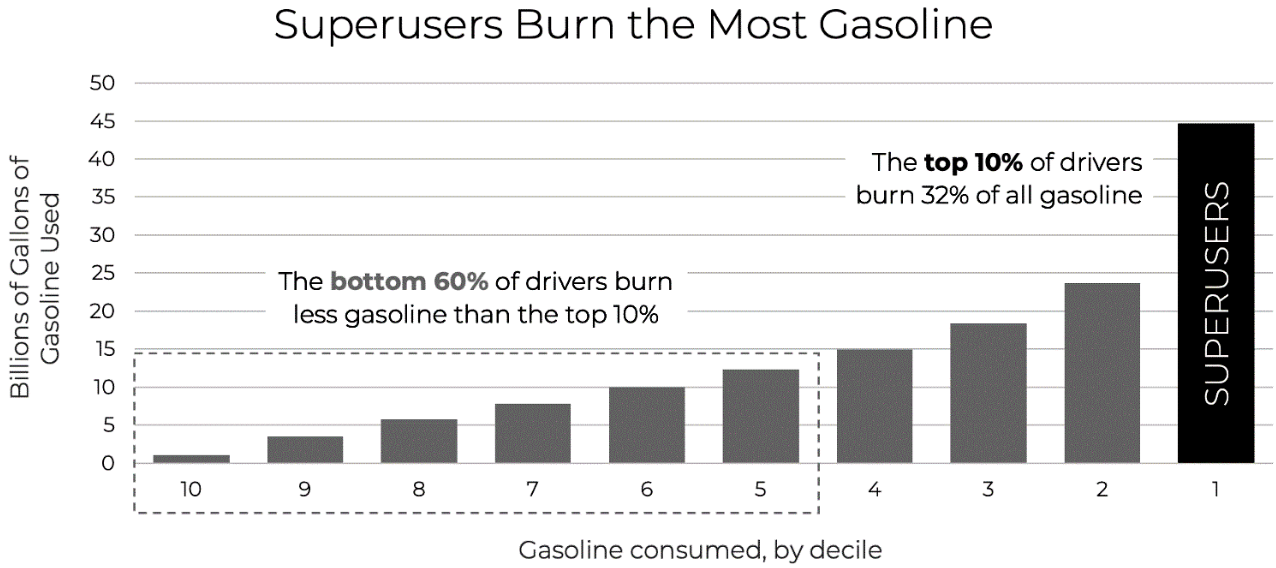
Electric vehicles (EVs) cause much lower carbon and particulate emissions than gasoline-burning internal combustion engine vehicles, while providing comparable (and often superior) performance and mobility.[6] EVs emit about three times less carbon than equivalent gas-powered cars in areas of the country where electricity is produced with natural gas, and run virtually carbon-free in areas where renewable or nuclear energy is dominant.[7] Even in regions that depend heavily on coal for electricity generation, EVs still have lower emissions than gas-powered cars.[8]

The U.S. EV market, while growing rapidly, is not on a trajectory to achieve the 96-billion-gallon cut in annual gasoline use required to meet 2030 targets.[9] EVs are a centerpiece of federal and state strategies to reduce emissions from light-duty vehicles burning gasoline.[10] The federal government presently offers a flat tax credit of $7,500 to the buyers of certain EVs,[11] and the recently passed bipartisan infrastructure bill will dedicate $7.5 billion to EV charging-site construction.[12] Thirteen state governments offer EV incentives to encourage their residents to purchase EVs.[13]

While the flat-rate incentives have been effective in helping EV models achieve a foothold in the market, they have been relatively ineffective in reducing gasoline consumption and resulting vehicle emissions. This is because early adopters of EVs tend to drive less than average drivers,[14] and the biggest consumers of gasoline have been slow to adopt EVs.[15] As a result, the gasoline reduction achieved by those switching to EVs has been disproportionately low in relation to their share of the U.S. light-duty vehicle fleet. As the urgency to cut carbon emissions grows, the need to maximize the gasoline reduction from each additional EV

1. U.S. Energy Information Administration (EIA), *Frequently Asked Questions (FAQS): What Countries Are the Top Producers and Consumers of Oil?*, https://www.eia.gov/tools/faqs/faq.php?id=709&t=6 (last updated Dec. 8, 2021).
2. U.S. Environmental Protection Agency (EPA), *Inventory of U.S. Greenhouse Gas Emissions and Sinks*, https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks (last updated Oct. 26, 2021).
3. Fact Sheet, The White House, President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies (Apr. 22, 2021), https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies/.
4. The IPCC warned in 2018 that global emissions must drop 45% from a 2010 baseline by 2030 to limit global warming to 1.5 degrees Celsius. IPCC, *Headline Statements*, https://www.ipcc.ch/sr15/resources/headline-statements/ (last visited Dec. 17, 2021).
5. This calculation takes into account upstream emissions from gasoline and electricity production. It does not include electric vehicle (EV) manufacturing emissions for two principal reasons. First, battery technology, manufacturing, and recycling processes are changing quickly, and it is not possible to predict with confidence the material composition of batteries and the energy requirements of battery manufacturing in 2030. Estimates of the carbon intensity of *existing* EV battery manufacturing vary enormously. *See, e.g.*, International Council on Clean Transportation, Effects of Battery Manufacturing on Electric Vehicle Life-Cycle Greenhouse Gas Emissions (2018), https://theicct.org/sites/default/files/publications/EV-life-cycle-GHG_ICCT-Briefing_09022018_vF.pdf. Second, reliable data is not available for calculating vehicle manufacturing emissions from the IPCC and Biden baseline years of 2010 and 2005.
6. *See, e.g.*, Union of Concerned Scientists, Electric Vehicles Are Cleaner Than Gasoline—and Getting Better (2020), https://www.ucsusa.org/sites/default/files/2020-05/evs-cleaner-than-gasoline.pdf; U.S. Department of Energy Alternative Fuels Data Center, *Emissions From Hybrid and Plug-In Electric Vehicles*, https://afdc.energy.gov/vehicles/electric_emissions.html (last visited Dec. 17, 2021); Dave Vanderwerp, *How EVs Compare to Gas-Powered Vehicles in Seven Performance Metrics*, Car & Driver (May 15, 2021), https://www.caranddriver.com/features/g36420161/evs-compared-gas-powered-vehicles-performance/.
7. Vanderwerp, *supra* note 6.
8. U.S. Department of Energy Alternative Fuels Data Center, *supra* note 6.
9. *See* Matthew Metz et al., Coltura, Gasoline Superusers 4-5 (2021), https://static1.squarespace.com/static/5888d6bad2b857a30238e864/t/60ff036e15db6a1139195020/1627325296710/Coltura+Gasoline+Superusers+Report+July+2021.pdf.
10. *See* Fact Sheet, The White House, *supra* note 3.
11. 26 U.S.C. §30D.
12. Infrastructure Investment and Jobs Act, Pub. L. No. 117-58, §11401, 135 Stat. 546 (2021).
13. Plug in America, *State & Federal Incentives*, https://pluginamerica.org/why-go-plug-in/state-federal-incentives/ (last visited Dec. 17, 2021).
14. *People Are Driving Electric Vehicles Less Than Projected*, U.C. Davis (Feb. 8, 2021), https://www.ucdavis.edu/climate/news/people-are-driving-electric-vehicles-less-projected.
15. Metz et al., *supra* note 9.

Figure 1. U.S. Light-Duty Vehicle Gasoline Consumption by Decile



Source: Chart generated from NHTS data. Calculations available at *Superusers*, https://github.com/PRosler/Superusers (last visited Jan. 10, 2022).

produced increases, especially as the near-term ability to produce EVs is constrained by the supply chain.

EV incentive policies have also increasingly come under scrutiny from equity advocates, who fault subsidies for being disproportionately given to the affluent.[16] Current policies are failing to maximize cuts in vehicle emissions that disproportionately affect communities of color and low-income communities.[17] Given the growing need to achieve rapid, near-term cuts in carbon emissions and the demand for more equitable distribution of EV subsidies, new EV policies are needed.

I. Refocusing EV Incentives on Gasoline Superusers

A. "Gasoline Superusers" Defined

Gasoline superusers are drivers who make up the top 10% of U.S. gasoline users.[18] Analysis of data from the National Household Travel Survey (NHTS)[19] indicates that they each burn more than 1,000 gallons of gasoline per year and collectively account for about one-third of U.S. gasoline use.[20] See Figure 1.

Superusers drive three times more than the average driver.[21] They tend to drive larger, less fuel-efficient pickups and sport utility vehicles (SUVs), and they are more likely to live in rural and exurban locations where EV penetration is low.[22] See Figure 2.

Superusers are spread across income and educational levels in the same general proportions as other drivers. In contrast, EV drivers skew toward being affluent and highly educated.

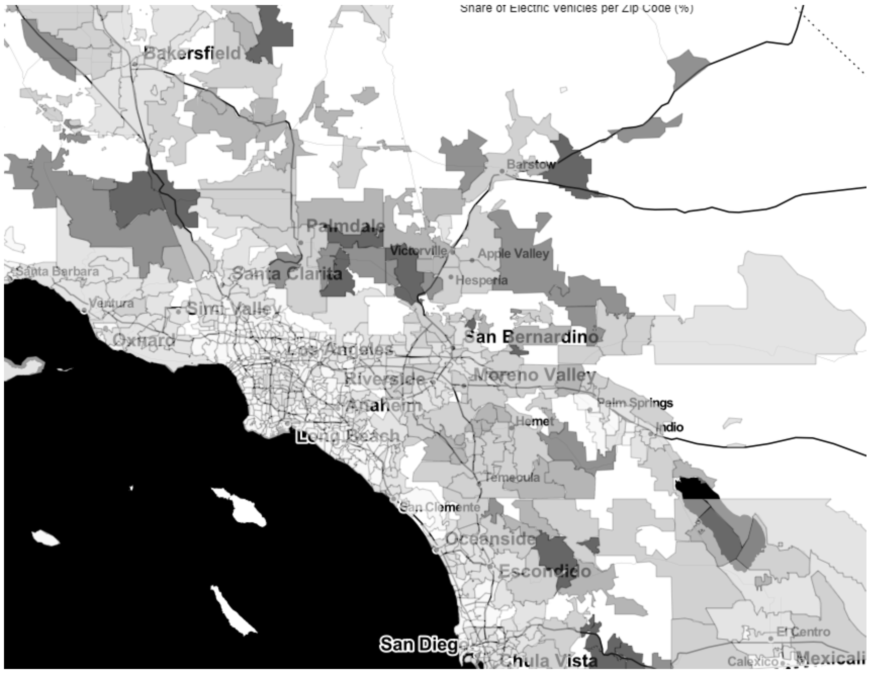
Superusers burn about 45 billion of the 147 billion gallons of gasoline consumed annually in the United States. Given the need to cut gasoline use by about 100 billion gallons to achieve a 50% cut in emissions in 2030 relative to 2005 levels, getting substantial numbers of superusers to switch to EVs is critical.

B. Policy Strategy: Replace One-Size-Fits-All Incentives With Incentives Targeted at Gasoline Displacement

EV purchase incentives should be optimized to maximize gasoline displacement and achieve maximum emissions reductions per taxpayer dollar. An effective and direct approach to displacing gasoline consumption would be requiring a gas-powered vehicle to be traded in for the EV and tying the amount of the EV purchase incentive to

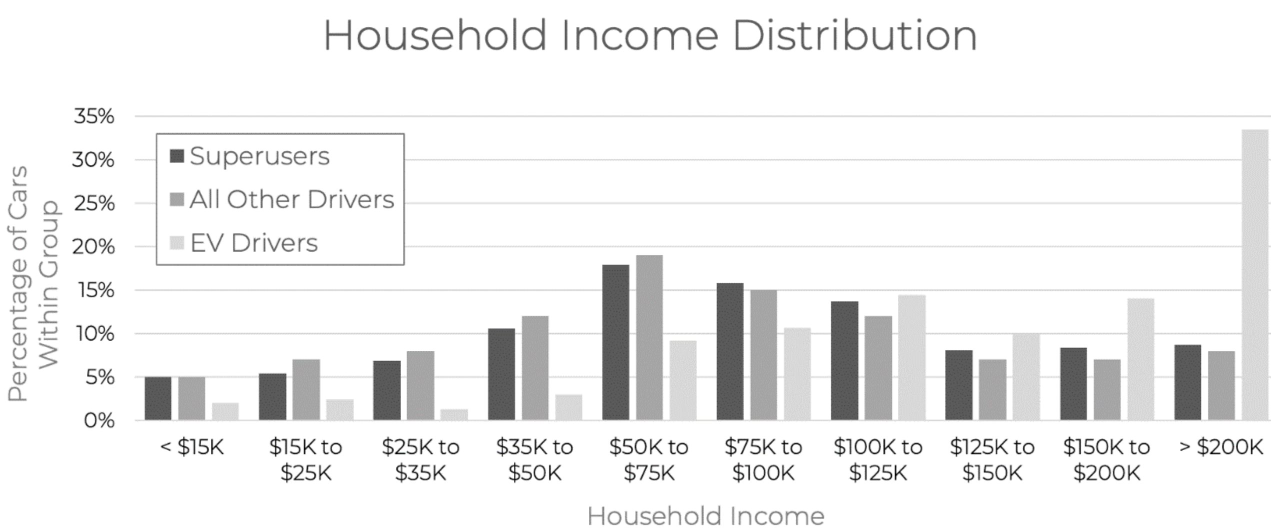
16. Scott Hardman et al., *A Perspective on Equity in the Transition to Electric Vehicles*, 2 MIT Sci. Pol'y Rev. 46 (2021), https://sciencepolicyreview.org/2021/08/equity-transition-electric-vehicles/.
17. Metz et al., *supra* note 9; *see also* Gregory C. Pratt et al., *Traffic, Air Pollution, Minority, and Socio-Economic Status: Addressing Inequities in Exposure and Risk*, 12 Int'l J. Env't Rsch. & Pub. Health 5355 (2015), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4454972/.
18. Metz et al., *supra* note 9.
19. Federal Highway Administration, U.S. Department of Transportation, *National Household Travel Survey*, https://nhts.ornl.gov/ (last visited Dec. 18, 2021).
20. Although the NHTS survey is of households, we assume each vehicle is driven by one driver and that each driver only drives one vehicle.
21. Metz et al., *supra* note 9.
22. *Id.*

Figure 2. Map of Gasoline Superusers in Southern California



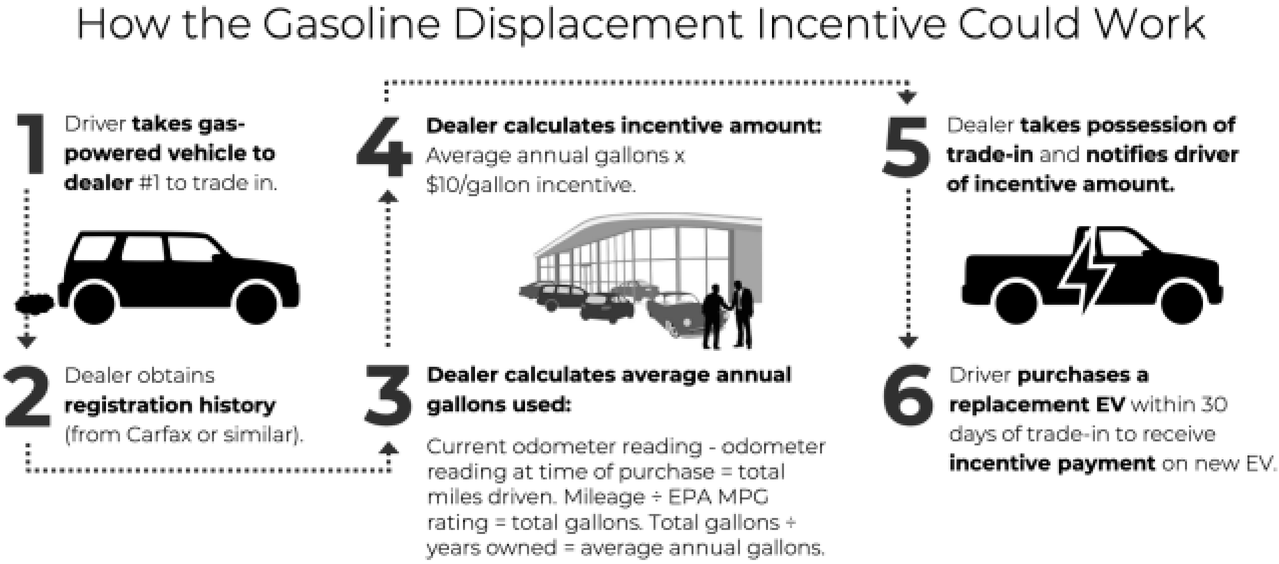
Note: The darker the shading of the zip code, the higher the percentage of superusers.
Source: Map generated from California Department of Motor Vehicles data provided pursuant to 2021 California Public Records Act request (on file with authors).

Figure 3. Household Income and Gasoline Consumption



Source: Chart generated from NHTS data. Calculations available at *Superusers*, https://github.com/PRosler/Superusers (last visited Jan. 10, 2022).

Figure 4. Model of EV Incentive Based on Past Gasoline Consumption



Source: Chart generated from NHTS data. Calculations available at *Superusers*, https://github.com/PRosler/Superusers (last visited Jan. 10, 2022).

the amount of annual gasoline consumption displaced by switching to an EV.[23] See Figure 4.

Table 1 shows how such an incentive would work for three drivers and their vehicles described in the NHTS. Using this approach and assuming an EV incentive rate of $10 per gallon of annual gasoline consumption, the Nissan Rogue driver profiled in the table, using 259 gallons per year, would receive a $2,590 incentive to switch to an EV. The Toyota Highlander driver using 468 gallons would receive a $4,680 incentive. The superuser driver of the Toyota Tacoma burning 2,335 gallons of gasoline per year would receive a $23,350 incentive to switch to an EV.

In contrast, if these drivers were given the current flat $7,500 EV incentive, the 259 gallon-a-year driver would receive $28.95 per gallon displaced per year, the 468-gallon driver would receive $16.02, and the 2,335-gallon superuser driver would receive only $3.21 per gallon displaced.

C. Effects of Gasoline Displacement Incentives

1. Increased EV Affordability for Superusers

Incentives based on gasoline displacement would allow superusers to better afford the new electric versions coming to market that are most popular with superusers: pickup trucks and SUVs. Presently, full-size gas-powered pickups and SUVs tend to cost significantly more than full-size gas cars.[24] Assuming cost parity among similar models of EVs and gas-powered vehicles (which many experts predict will occur in the mid-2020s[25] and as early as 2022 for larger EVs[26]), the current $7,500 federal EV tax incentive would cover about one-third less of the cost of an electric pickup relative to the cost of an electric sedan. In contrast, a subsidy of $10 per gallon of gasoline displaced annually would cover up to one-half of the purchase cost of many EVs for gasoline superusers.

2. Fuel and Maintenance Savings

Fuel and maintenance cost savings bolster the impact of gasoline displacement incentives.[27] Assuming gasoline costs $4 per gallon, the superuser pickup truck driver in Table 1 below will save $648 per month by fueling with electricity (and more if the driver can charge at reduced nighttime rates or with rooftop solar panels).[28] In addition,

23. Annual gasoline consumption can be estimated by dividing miles traveled since a vehicle was purchased by its EPA miles-per-gallon (MPG) rating and the number of years it has been owned. For example, a vehicle with an EPA rating of 20 MPG that has traveled 100,000 miles since it was purchased in 2016 and replaced after five years would have an annual consumption of 1,000 gallons. Odometer readings are required to purchase and sell a vehicle.

24. AAA, Your Driving Costs (2021), https://info.oregon.aaa.com/wp-content/uploads/2021/08/2021-YDC-Brochure.pdf.

25. Jasper Jolly, *Electric Cars "as Cheap to Manufacture" as Regular Models by 2024*, Guardian (Oct. 21, 2020, 2:04 PM), https://www.theguardian.com/environment/2020/oct/21/electric-cars-as-cheap-to-manufacture-as-regular-models-by-2024.

26. Elisabeth Behrmann, *Where We Are on the Road to Electric Vehicles*, Bloomberg (Aug. 6, 2021, 2:23 PM), https://www.bloomberg.com/news/articles/2021-06-26/where-we-are-on-the-road-to-electric-vehicles-quicktake?sref=JN1HDH2Z.

27. *See, e.g.*, Chris Harto, Consumer Reports, Electric Vehicle Ownership Costs: Today's Electric Vehicles Offer Big Savings for Customers (2020), https://advocacy.consumerreports.org/wp-content/uploads/2020/10/EV-Ownership-Cost-Final-Report-1.pdf.

28. One policy option to maximize emissions reductions from conversion to EVs and save drivers money would be to provide additional incentives to drivers who install rooftop solar or purchase an interest in a community

Table 1. Comparison of Vehicles Under Per-Gallon and Per-Vehicle Subsidy Scenarios

	2011 Nissan Rogue (compact SUV)	2005 Toyota Highlander (SUV)	2010 Toyota Tacoma (Pickup Truck)
Annual mileage	6,000	10,000	45,000
Annual gallons displaced	259	468	2,335
EV incentive @ $10/gallon displaced	$2,590	$4,680	$23,350
Monthly fuel savings with EV	$69	$127	$648
Monthly maintenance savings with EV	$15	$25	$113
Trade-in value (per Consumer Reports)	$5,185	$3,090	$10,425
Similar EV	Hyundai Kona EV	Tesla Model Y	Ford F-150E
Price of EV	$40,000	$55,000	$44,000
Net EV cost after subsidy and trade-in	$32,225	$47,230	$10,225
Monthly car payment on EV (assume 6 years @ 5%)	$529.07	$775.43	$167.88
Monthly cost (savings) to switch to EV	-$445.14	-$623.43	$592.95
Taxpayer cost per gallon displaced under existing flat $7,500 subsidy	$28.95	$16.02	$3.21

Assumptions: Vehicles achieve U.S. Environmental Protection Agency miles-per-gallon (MPG) rating. Gasoline $4 per gallon. Electricity 12 cents per kilowatt hour (kWh). Efficiency .29 kWh per mile. No loan on the existing vehicle. New EV cost is the lowest available sticker price plus 10%, then rounded up to the nearest thousand.

Source: Chart generated from NHTS data. Calculations available at *Superusers*, https://github.com/PRosler/Superusers (last visited Jan. 10, 2022).

the pickup truck driver will save about $113 monthly in maintenance costs by switching to a new electric pickup.[29] In sum, superusers who trade from an old pickup or SUV to a new EV of similar size will have lower monthly all-in vehicle costs by switching to an EV in addition to the greater reliability of driving a new vehicle.

3. Equity Benefits

Because gasoline superusers tend to have racial and income distributions similar to those of the general population, targeting incentives to superusers would distribute incentives more equitably than one-size-fits-all EV subsidies, which have been primarily used by a predominantly affluent demographic.

Across the country, fueling with electricity costs less than one-half what fueling with gasoline does, on average.[30] For lower-income superusers, gasoline may account for up to one third of their household income (compared to 8% for average superuser households).[31] Maintenance expenditures on gasoline-powered vehicles can be many thousands of dollars, and can cause financial shock for low-income families.[32] Thus, the cost savings realized by switching to an EV disproportionately benefit lower income superusers. Equity benefits could be further enhanced by offering more money per gallon displaced to drivers in lower-income and disadvantaged communities. For instance, these drivers could be offered a $15-per-annual-gallon-displaced incentive instead of the $10 per gallon other superusers would get.

4. Emissions Benefits

Achieving 50% carbon reduction from light-duty vehicles will require cutting gasoline use by approximately 67% by 2030.[33] This will mean cutting U.S. annual gasoline sales from today's 143 billion gallons to 47 billion gallons.

We are not currently on track to achieve these cuts. Across the United States, gasoline use is going up, not down.[34] Even California, the state with one-half the coun-

solar program. A six-kilowatt solar system would supply all the electrical power needed for an average superuser's EV.

29. For discussion of relative maintenance costs for internal combustion engine vehicles and EVs, see Harto, *supra* note 27.

30. *See* U.S. Department of Energy, *eGallon*, https://www.energy.gov/maps/egallon (last visited Dec. 17, 2021).

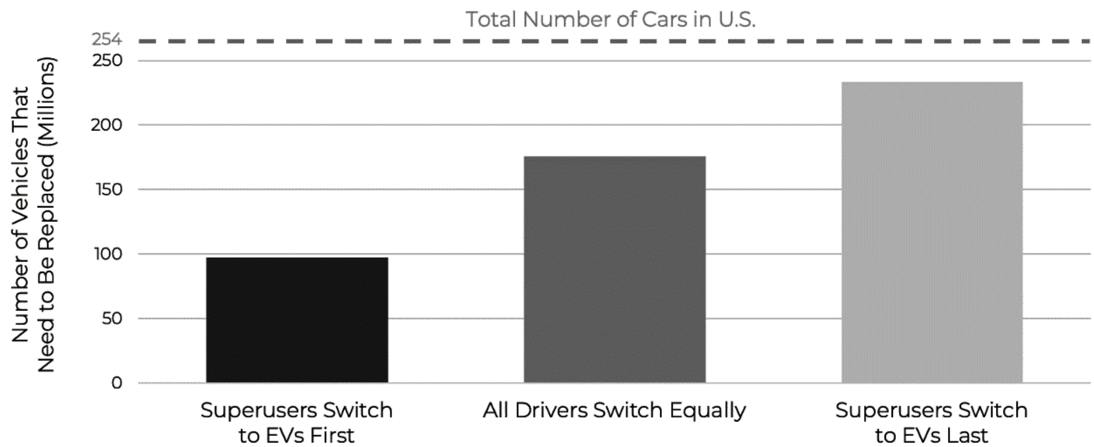
31. Metz et al., *supra* note 9.

32. Pew Charitable Trusts, How Do Families Cope With Financial Shocks? (2015), https://www.pewtrusts.org/~/media/assets/2015/10/emergency-savings-report-1_artfinal.pdf.

33. EVs run on electricity, which is often produced with carbon-emitting sources, such as natural gas and coal. The analysis assumes that the carbon content of electricity production declines by roughly 50% by 2030 relative to 2005 in accordance with EIA estimates. EIA, *Annual Energy Outlook 2021*, https://www.eia.gov/outlooks/aeo/electricity/sub-topic-03.php (last released Feb. 3, 2021).

34. *See* @USDOTFHWA, Twitter (Jan. 22, 2020, 11:00 AM), https://twitter.com/USDOTFHWA/status/1220013487759544321.

Figure 5. Comparison of Vehicles That Would Need to Be Replaced to Achieve 67% Gasoline Use Reduction



Source: Chart generated from NHTS data. Calculations available at *Superusers*, https://github.com/PRosler/Superusers (last visited Jan. 10, 2022).

try's EVs, held steady at about 15 billion gallons of gasoline consumption per year from 2015 to 2019.[35]

With limited time and resources, the question is how to develop policy to achieve the necessary cuts in gasoline use most efficiently and cost effectively. The faster superusers transition to EVs, the fewer EVs will be needed to cut light-duty vehicle emissions in half by 2030.

As depicted in Figure 5, if superusers converted to EVs first, 97 million of America's 267 million light-duty vehicles would need to be switched to EVs by 2030—11 million per year. If all drivers converted to EVs at the same rate regardless of how much gasoline they use, it would take 176 million vehicles switching to EVs by 2030 to hit the emissions goal. If superusers were the last drivers to switch to EVs, it would take 233 million vehicles—100% of non-superusers, plus 10 million superusers—to hit the goal.

Even with the strongest policies, EV purchasing will likely fall somewhere between the extremes of all superusers switching first or last. The faster superusers make the switch, the fewer EVs will be needed to hit the target.

5. More Efficient Use of Scarce Resources

As noted above, superusers tend to drive larger vehicles such as pickup trucks. Electric models of these vehicles are just now entering the market, and initial production levels are insufficient to meet market demand. For instance, Ford Motor Company has had to halt reservations for the electric Ford F-150, with 200,000 on the waitlist and a maximum production capacity of only 70,000 to 80,000 vehicles in 2022.[36] Incentives sufficient to get superusers to register for these vehicles will help ensure the few that are available are displacing as much gasoline as possible, rather than getting into the hands of drivers who may drive them much less.

D. Gasoline Displacement Incentives as Viable Alternative to Carbon Pricing

Gasoline displacement incentives involve the pricing of carbon, but function by paying people to displace pollution instead of taxing them for polluting. A $10-per-gallon gasoline displacement incentive is roughly equal in value to a $100-per-ton carbon price.[37] In essence, a carbon tax *charges* drivers $100 to emit one ton of carbon, and a $10-per-gallon displacement incentive *pays* drivers $100 *not* to emit one ton of carbon.

35. *See* California Department of Tax and Fee Administration, *Fuel Taxes Statistics & Reports*, https://www.cdtfa.ca.gov/taxes-and-fees/spftrpts.htm (last visited Dec. 17, 2021).

36. Matthew J. Belvedere, *Ford Stops Reservations for F-150 Lightning Electric Pickup Due to Strong Demand, CEO Tells Cramer*, CNBC (Dec. 9, 2021), https://www.cnbc.com/2021/12/09/ford-stops-reservations-for-f-150-lightning-electric-pickup-because-of-demand-ceo-tells-cramer.html.

37. The math is as follows: one metric ton is equal to 2,204 pounds. One gallon of gasoline emits 25 pounds of carbon dioxide (CO_2). One hundred ten gallons of gasoline emit 2,750 pounds of CO_2. Therefore, a price of $100/ton of CO_2 is roughly equal to $1.20/gallon of gasoline. Given that the carbon-reduction benefits of an EV will likely accrue for eight years or more, the $10/gallon gasoline incentive and the $100/metric ton carbon tax are quite close in their valuation of carbon. For similar calculations, see Ed Hirs, *What Will an American Carbon Tax Cost You?*, FORBES (July 21, 2020, 9:28 AM), https://www.forbes.com/sites/edhirs/2020/07/21/what-will-an-american-carbon-tax-cost-you/.

Unlike carbon taxes, which impose higher costs on people who use more gasoline and are generally regressive in nature,[38] gasoline displacement incentives are paid for out of the overall federal tax base (which tends to fall less heavily on low-income persons[39]) or with public debt. Further, unlike gasoline taxes, which consumers pay in relatively small increments over time, gasoline displacement incentives are realized all at once by the recipient, which may more effectively motivate change.

II. Conclusion

Gasoline superusers' conversion to EVs will yield enormous carbon reductions. If state and federal incentive programs are revised to provide sufficient motivation for these drivers to replace their gas vehicles with EVs, the United States will be able to achieve its transportation emission reduction goals more quickly and efficiently. These drivers will also experience enormous savings, and equity will be advanced.

38. *See*, *e.g.*, William A. Pizer & Steven Sexton, *The Distributional Impacts of Energy Taxes*, 13 Rev. Env't Econ. & Pol'y 104 (2019).
39. *See*, *e.g.*, David Splinter, *US Tax Progressivity and Redistribution*, 73 Nat'l Tax J. 1005 (2020).