

Easing Off the Gas: Efficient and Equitable Policy for Passenger Vehicle Emissions Reduction

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INTRODUCTION

Since 1986, overall gaseous fuel emissions have increased significantly in the United States, rising from 817,454 kilotons of carbon produced in 1986 to a level nearly twice as high in 2014, at 1,440,397 kilotons.¹ As of 2018, the United States emitted 15 percent of the global carbon dioxide emissions from fuel combustion, the second-highest overall level for any country behind only China,

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1. *CO2 Emissions from Gaseous Fuel Consumption (kt)*, WORLD BANK GROUP (2019), https://data.worldbank.org/indicator/EN.ATM.CO2E.GF.KT?locations=US&name_desc=true.

and produced the third-highest per capita rate of carbon dioxide emissions from fuel combustion worldwide at an average rate of 16.56 metric tons.²

Carbon dioxide emissions from passenger vehicles are concerning, of course, because of their contributions to climate change.³ Scientific computer-based models have shown that rising concentrations of greenhouse gasses (GHGs) in the atmosphere raise Earth's surface temperatures over time, causing increased storm severity, rising sea levels, and changing precipitation patterns.⁴ Consistent patterns of global surface temperature warming since 1976 have led to surface temperatures that are rising at an alarming rate.⁵ Recent research has estimated that the cost of GHG damages to social welfare as a result of climate impact substantially slows economic growth, by a rate of approximately \$220 per ton.⁶ The current trajectory of overall GHG emissions, both global and within the United States, has the potential to result in drastic consequences.

Transportation is the largest economic sector in terms of contribution to GHG emissions in the United States at 28.9 percent of overall emissions. Passenger vehicles make up a majority, comprising 60 percent of these transportation sector GHG emissions, with the average light-duty vehicle emitting 4.6 metric tons of carbon dioxide each year.⁷

There are various public policy approaches to addressing passenger vehicle carbon emissions. In this article I review three possible approaches: raising emissions standards; alternative fuel vehicle subsidies; and congestion charging zones. I propose a set of criteria for evaluating these different policies, and apply those criteria to the three policies. I conclude that a combination of increased passenger vehicle emissions standards and subsidies for alternative fuel vehicles represents the best policy approach.

I. POLICY ALTERNATIVES

A. Raising Emissions Standards

One of the most widely circulated alternative policy solutions to reducing passenger vehicle carbon emission in the United States is raising the federal

2. *Each Country's Share of CO₂ Emissions*, UNION OF CONCERNED SCIENTISTS (last updated Aug. 12, 2020), <https://www.ucsusa.org/global-warming/science-and-impacts/science/each-country-share-of-co2.html>.

3. *The Cost of Energy: Environmental Impact*, THE NAT'L ACADS. OF SCI., ENG'G, & MEDICINE, <http://needtoknow.nas.edu/energy/energy-costs/environmental/> (last visited Sept. 27, 2020).

4. *Greenhouse Gas Emissions and Atmospheric Concentrations Have Increased Over the Past 150 Years*, ENERGY INFO. ADMIN. (last updated Oct. 4, 2019), https://www.eia.gov/energyexplained/index.php?page=environment_how_ghg_affect_climate.

5. See Rebecca Lindsey & LuAn Dahlman, *Climate Change: Global Temperature*, NAT'L OCEANIC AND ATMOSPHERIC ADMIN. (Aug. 14, 2020), <https://www.climate.gov/news-features/understanding-climate/climate-change-global-temperature>.

6. Frances C. Moore & Delavane B. Diaz, *Temperature Impacts On Economic Growth Warrant Stringent Mitigation Policy*, NATURE (Jan. 12, 2015), <https://www.nature.com/articles/nclimate2481>.

7. *Sources of Greenhouse Gas Emissions: Transportation Sector Emissions*, U.S. ENVTL. PROT. AGENCY, <https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions#transportation> (last visited Sept. 27, 2020).

emissions standards. Federal emissions standards are regulated primarily under the Clean Air Act (CAA) and overseen by the Environmental Protection Agency (EPA).⁸ The state of California is authorized to adopt and enforce emissions standards distinct from federal standards, as long as they protect both public health and welfare at least to the extent of the federal standards.⁹ As a result of this exemption in California, passenger vehicles are almost exclusively manufactured to meet California emissions standards throughout the United States to achieve uniformity of production by vehicle manufacturers.¹⁰ Other states are unable to establish their own emissions standards, but they do have the ability to match their emissions standards to those of California. Twelve states and the District of Columbia currently follow California's emissions standards.¹¹

The Energy Security and Independence Act (EISA) was introduced and signed into law in 2007,¹² and marked a significant legislative action to raise fuel economy standards for passenger and non-passenger vehicles. EISA repealed the previous standard, which required car companies to ensure that their fleet of passenger vehicles averaged 27.5 miles-per-gallon (MPG) for cars produced after 1984.¹³ Under the new EISA standard, the overall fleet of passenger and non-passenger vehicles manufactured for sale in the United States by a single company had to meet a minimum average fuel economy of 35 MPG by 2020.¹⁴ This was followed in 2009 by the National Fuel Efficiency Policy, which raised the previous minimum fuel efficiency standards under the EISA to 35.5 MPG by 2016.¹⁵ This fuel efficiency standard increase was projected to decrease oil use by 1.8 billion barrels and reduce GHG emissions by 900 million metric tons from 2012 to 2016.¹⁶

The Obama administration also oversaw the cooperation of the EPA, California Air Resources Board (CARB), National Highway Traffic Safety Administration (NHTSA), and vehicle manufacturing corporations to develop a federal system referred to as the Clean Car Standards, which were designed to gradually raise fuel efficiency standards for passenger vehicles, as well as light

8. 42 U.S.C. §§ 7401-7671q.

9. 42 U.S.C. § 7543.

10. *Vehicle Emissions California Waivers and Authorizations*, U.S. ENVTL. PROT. AGENCY, <https://www.epa.gov/state-and-local-transportation/vehicle-emissions-california-waivers-and-authorizations#:~:text=The%20Clean%20Air%20Act%20allows,California's%20rules%20may%20be%20enforced> (last visited Sept. 27, 2020).

11. *Tailpipe Emission Standards*, AM. COUNCIL FOR AN ENERGY-EFFICIENT ECON., <https://database.aceee.org/state/tailpipe-emission-standards> (last visited Sept. 27, 2020).

12. Energy Independence and Security Act of 2007, Pub. L. No. 110-140, 121 Stat. 1492 (2007).

13. *Id.*

14. *Id.*

15. The White House: Office of the Press Secretary, *President Obama Announces National Fuel Efficiency Policy* (May 19, 2009), <https://obamawhitehouse.archives.gov/the-press-office/president-obama-announces-national-fuel-efficiency-policy>.

16. *Id.*

trucks.¹⁷ These standards would maintain annual increases in average fuel efficiency standards through 2026 and progressively raise these standards for automakers to 54.5 MPG by 2025, affecting California, along with the 13 other states and District of Columbia that follow California emissions standards, which would include approximately 113 million people and 85 million passenger vehicles.¹⁸

B. *Alternative Fuel Vehicle Subsidies*

A second policy alternative that has been gaining traction in recent years is public subsidies for alternative fuel vehicles. These subsidies would implement measures such as tax credits and incentives for citizens to purchase vehicles that run either partially or completely from energy sources other than traditional passenger vehicle fuel.¹⁹ Thus far, two methods of subsidizing alternative fuel vehicles have been implemented, both federally and at the state level: 1) alternative fuel vehicles funding for government and private organizations; and 2) individual consumer tax credits for the purchase, lease, or conversion of alternative fuel passenger vehicles.²⁰

A small number of federal subsidies for alternative fuel passenger vehicles have been enacted in the past decade. Plug-in electric passenger vehicles are eligible for federal tax credits with a base rate of \$2,500, plus additional credits based on the battery power of a vehicle, for a maximum total credit of \$5,000.²¹ Hydrogen fuel cell vehicles were also eligible for up to \$4,000 in federal tax credits, however this program was terminated in 2017 and has not been renewed.²² Additionally, the American Recovery and Reinvestment Act of 2009 authorized \$3 billion for the acquisition of new alternative fuel federal vehicles.²³

A number of states and cities have also implemented tax credit and incentives targeted at increasing ownership of alternative fuel passenger vehicles and reducing the number of traditional fuel passenger vehicles.

In Pennsylvania, the Alternative Fuels Incentive Grant (AFIG) program was established in 1992 to assist in the development of private markets for the alternative fuel passenger vehicles, with approximately \$6 million in AFIG

17. *Clean Car Standards*, STATE ENERGY & ENVTL. IMPACT CTR., <https://www.law.nyu.edu/centers/state-impact/issues/climate-action/clean-car-standards> (last visited Sept. 27, 2020).

18. *Id.*

19. There are currently a number of federal and state laws and incentives in place for alternative fuel and advanced vehicle purchase and ownership. Further information on these laws and incentives can be found through the U.S. Department of Energy at <https://afdc.energy.gov/laws/search>.

20. See, e.g., Kristy Hartman & Emily Dowd, *State Efforts to Promote Hybrid and Electric Vehicles*, NAT'L CONFERENCE OF STATE LEGS. (Sept. 26, 2017), <https://www.ncsl.org/research/energy/state-electric-vehicle-incentives-state-chart.aspx>.

21. 26 U.S.C. § 30(D).

22. 26 U.S.C. § 30(B).

23. American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, 123 Stat. 115 (2009).

grants dispersed each year.²⁴ The AFIG program in Pennsylvania is not targeted at individual consumers, but rather at vehicle fleets operated by school districts, municipal authorities, corporations, non-profit organizations, and political subdivisions.²⁵ These entities can receive grant funds between \$1,000 and \$7,5000 per electric passenger vehicle, dependent on the kilowatt size of the vehicle battery, and \$7,500 for passenger vehicles fueled by compressed natural gas (CNG), liquified natural gas (LNG), propane, biodiesel, or hydrogen fuel cells.²⁶

Colorado has implemented a statewide alternative fuel vehicle tax credit program that is applicable to leasing, purchasing, or converting vehicles, including passenger vehicles.²⁷ Passenger vehicles can receive a tax credit of up to \$5,000 on the purchase of vehicles registered within the state and conversion costs to create hybrid fuel source passenger vehicles until 2020, with per-vehicle credits reducing to \$4,000 in 2021, and \$2,500 in 2022 under current legislation.²⁸ Tax credits on applicable vehicle leases can amount to \$2,500 per vehicle until 2020, \$2,000 per vehicle until 2021, and \$1,500 per vehicle until 2026.²⁹

C. Congestion Charging Zones

Congestion Charging Zones (CCZ) have been implemented primarily in cities both within the United States and internationally.³⁰ CCZs impose a fee on all passenger vehicles that enter a given geographical area, typically in busy urban centers, during a given time period, typically during the busiest times of the day for passenger vehicle traffic.³¹ The central goal of this reform is to reduce vehicle emissions, particularly within a busy locale, by implementing a cost to consumers that is expected to reduce the number of overall vehicle usage, thereby reducing overall emissions output.³²

New York City enacted a congestion surcharge on April 1, 2018, which began on January 31, 2019. This was the first time any city or state in the United States had enacted legislation imposing a CCZ.³³ The congestion surcharge is

24. *Alternative Fuel Incentive Grants Program (AFIG)*, PENNSYLVANIA DEP'T OF ENVTL. PROT., <https://www.dep.pa.gov/Citizens/GrantsLoansRebates/Alternative-Fuels-Incentive-Grant/Pages/default.aspx>.

25. *Id.*

26. *Id.*

27. *Alternative Fuel Vehicle Tax Credits*, COLORADO ENERGY OFFICE, <https://www.colorado.gov/pacific/energyoffice/alt-fuel-vehicle-tax-credits> (last visited Sept. 27, 2020).

28. *Innovative Motor Vehicle and Truck Credits for Electric and Plug-in Hybrid Electric Vehicles*, COLORADO DEP'T OF REVENUE (Dec. 2019), <https://www.colorado.gov/pacific/sites/default/files/Income69.pdf>.

29. *Id.*

30. *See Congestion Charge/ULEZ Zone*, TRANSP. FOR LONDON, <https://tfl.gov.uk/modes/driving/congestion-charge/congestion-charge-zone> (last visited Sept. 27, 2020).

31. *Id.*

32. *Id.*

33. Laurel Wamsley, *New York is Set to Be First U.S. City to Impose Congestion Pricing*, NAT'L PUB. RADIO (Apr. 2, 2019), <https://www.npr.org/2019/04/02/709243878/new-york-is-set-to-be-first-u-s->

applicable to passenger vehicles that “carry people for-hire” through the borough of Manhattan below 96th street.³⁴ The surcharge is placed as a flat rate on each passenger vehicle which provides the transportation, with a \$0.75 surcharge on pool vehicles, \$2.50 surcharge for taxis with medallions, and \$2.75 surcharge for all other for-hire vehicles.³⁵ There is also a proposed surcharge on individually operated not-for-hire vehicles below 60th street in Manhattan to be implemented in 2020. According to an analysis from Fix NYC—a commission established by New York Governor Andrew Cuomo—a one-way congestion surcharge of \$11.52 would raise approximately \$705 million in gross revenue from passenger vehicles and assist low-income New York City residents by improving public transit funding (the surcharge would have only a minimal effect on transportation costs for low-income residents because only approximately 4 percent of this demographic drives passenger vehicles into Manhattan as opposed to taking public transit).³⁶

London has implemented both a CCZ and what is known as an “Ultra Low Emission Zone.”³⁷ Congestion charging was implemented in a 21-square-kilometer area of central London in 2003.³⁸ Four years after the introduction of these congestion charges, the vehicles congestion rates in the targeted area was down 22 percent, nitrogen oxide emissions were reduced by 13 percent, particulate matter emissions decreased by 15 percent, and similar reductions were seen in carbon dioxide tailpipe emissions.³⁹ An additional congestion charging measure was enacted in London, referred to as the “Ultra Low Emissions Zone” (ULEZ).⁴⁰ The ULEZ standards implement an additional surcharge fee on vehicles that do not meet strict emissions standards, further seeking to reduce vehicle tailpipe emissions in the city.⁴¹ ULEZ standards are specifically targeted at smaller passenger vehicles, as opposed to larger vans and trucks that are also charged under “Low Emission Zone” (LEZ) standards,

[city-to-impose-congestion-pricing#:~:text=New%20York%20is%20set%20to%20be%20first%20U.S.%20city%20to%20impose%20congestion%20pricing.-Facebook&text=Angerer%2FGetty%20Images-.After%20gaining%20approval%20from%20state%20lawmakers%2C%20New%20York%20will%20become,Midtown%20Manhattan%20in%20January%202018.](#)

34. N.Y. STATE DEP’T OF TAXATION AND FIN., *Congestion Surcharge*, <https://www.tax.ny.gov/bus/cs/csidx.htm> (last visited Sept. 27, 2020).

35. *Id.*

36. FIX NYC ADVISORY PANEL, *FIX NYC ADVISORY PANEL REPORT* (2018), <https://cdn.shopify.com/s/files/1/0703/6475/files/Fix-NYC-Panel-Report-Transmittal-Appendix-B.pdf>.

37. *Ultra Low Emission Zone*, TRANSP. FOR LONDON, <https://tfl.gov.uk/modes/driving/ultra-low-emission-zone> (last visited Sept. 27, 2020).

38. CENTRE FOR PUBLIC IMPACT, LONDON’S CONGESTION CHARGE 3, 6 (2016), <https://www.centreforpublicimpact.org/case-study/demand-management-for-roads-in-london/>.

39. TRANSP. FOR LONDON, CENTRAL LONDON CONGESTION CHARGING (2006), <http://content.tfl.gov.uk/fourth-annual-report-overview.pdf>.

40. Greater London Authority, *The Mayor’s Ultra Low Emission Zone for London*, <https://www.london.gov.uk/what-we-do/environment/pollution-and-air-quality/mayors-ultra-low-emission-zone-london> (last visited Sept. 27, 2020).

41. *Id.*

putting daily charges of 5 pounds on standard fuel passenger vehicles and 6 pounds for diesel passenger vehicles.⁴²

ULEZ policies have become particularly necessary as a measure for targeting passenger vehicle emissions in London, as much of the area covered by ULEZ in central London fails to meet EU air quality standards, and studies have found that London air pollution is measurably restricting the lung development of children growing up in the city.⁴³

In China, the implementation of CCZs similar to those established in London resulted in a 3 percent reduction in airborne particulate matter and a 10–15 percent reduction in overall vehicle emissions in inner city areas.⁴⁴

II. CRITERIA

To adequately assess the outcomes of keeping the current state of passenger vehicle emissions unchanged or implementing alternative measures to passenger vehicle emissions, a set of criteria should be established. I propose that the following measures should be used to assess outcomes: 1) effectiveness in reducing emissions, 2) efficiency to implement, 3) social equity, 4) cost to implement, and 5) feasibility.

A. *Effectiveness in Reducing Emissions*

Integral to assessing whether a policy alternative designed to reduce emissions levels from passenger vehicles is inspecting the ability for the policy suggestion to actually effectively reduce emissions levels. Measurement for effectiveness will consider the rate of reduction in passenger vehicles emissions, as well as that reduction in relation to possible increases in emissions from alternative energy sources used to replace standard fuel. An effective policy will create a large reduction in passenger vehicle emissions with little to no increase in emissions from alternative energy sources.

B. *Efficiency to Implement*

The ability to efficiently implement an alternative policy is also important. The efficiency measurement will consider the pace at which a policy alternative can be implemented, as well as the ease of carrying out implementation procedures.

42. City of London, *Ultra Low Emissions Zone*, <https://www.cityoflondon.gov.uk/business/environmental-health/environmental-protection/air-quality/Pages/ultra-low-emission-zone.aspx>.

43. See, e.g., Ian Mudway & Chris Griffiths, *London Air Pollution is Restricting Children's Lung Development - New Research*, THE CONVERSATION (Nov. 15, 2018), <https://theconversation.com/london-air-pollution-is-restricting-childrens-lung-development-new-research-106909>.

44. YING WANG ET AL., WORLD RES. INST. STUDY ON INTERNATIONAL PRACTICES FOR LOW EMISSIONS ZONE AND CONGESTION CHARGING 29, 58 (2017), https://wrimexico.org/sites/default/files/Study_on_International_Practices_for_Low_Emission_Zone_and_Congestion_Charging_0.pdf.

C. Social Equity

The ability for a passenger vehicle emissions reduction policy to spread benefits across populations, and particularly to the most vulnerable and in need, is central to the criteria for determining policy outcomes and ultimately the best policy decision. Criteria for social equality will evaluate the benefits and costs for populations based on both geographic area and economic status. It is important to note that these two aspects are typically closely connected, as many geographic areas that are disproportionately affected by the costs of pollution are also economically constrained, causing a cyclical pattern of negative impact.⁴⁵ A strong policy will assist in breaking this cycle.

D. Cost to Implement

Determining the monetary cost of implementing a given policy will be another important method of evaluating policy alternatives. If the financial cost of implementing a policy is too high, then it is not likely to be implemented.

E. Feasibility

The criteria for feasibility will consist of two points of feasibility: 1) operational feasibility and 2) political feasibility. Operational feasibility will inspect the ability to put into place organizational mechanisms to carry out a policy alternative. Greater ease at which these mechanisms can be put into place and administered reflects a stronger policy decision. Political feasibility reviews the expected likelihood of the policy alternative to be implemented, given the level of support for implementing the policy in terms of public opinion and political leadership.

45. Anjum Hajat et al., *Socioeconomic Disparities and Air Pollution Exposure: A Global Review*, 2 *CURRENT ENVTL. HEALTH REPORTS* 440 (2015).

III. OUTCOMES

A. Outcome Matrix

Policy	Effectiveness in Reducing Emissions	Efficiency to Implement	Social Equity	Cost to Implement	Feasibility O = Operational P = Political
Present Trends Continue	Low	N/A	Moderate	N/A	O: High P: Moderate
Raising Emissions Standards	High	High	Moderate	Moderate	O: High P: Moderate
Alternative Fuel Vehicle Subsidies	High	Moderate	High	Moderate	O: Moderate P: Moderate
Congestion Charging Zones	Moderate (Urban) Low (Suburban) Low (Rural)	Moderate	High	Low	O: Moderate P: Moderate

B. Present Trends Continue

Allowing present passenger vehicle emissions trends to continue may be an attractive choice for many parties, as there is no change to the status quo and no additional costs to implement. It is highly operationally feasible to make present trends continue, and may be highly politically feasible as well. However, as climate change is becoming an increasingly significant aspect of political life in the United States, allowing present trends to continue may be increasingly politically unpopular, and thus less feasible.⁴⁶ Additionally, allowing present trends to continue is the least effective way of carrying out the ultimate goal of reducing passenger vehicle emissions. Current trends do reflect that carbon dioxide emissions from vehicles have continued to decrease over the past four decades in new vehicles.⁴⁷ This trend of emissions reduction, however, is due

46. See Bruce Stokes et al., *Global Concern about Climate Change, Broad Support for Limiting Emissions*, PEW RESEARCH CTR., <https://www.pewresearch.org/global/2015/11/05/global-concern-about-climate-change-broad-support-for-limiting-emissions/> (last visited Sept. 27, 2020).

47. U.S. Env't Prot. Agency, *The 2018 EPA Automotive Trends Report: Greenhouse Gas Emissions, Fuel Economy, and Technology Since 1975* 3 (2019), <https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockkey=P100W3WO.pdf>.

largely in part to increased fuel efficiency standards required for passenger vehicles. As a result, if no further increases in fuel efficiency standards or regulation are put into place, passenger vehicle emissions likely would not continue to decrease at the rates at which they currently are decreasing.

C. Raising Emissions Standards

Raising emissions standards has shown to be quite effective in achieving reductions in passenger vehicle tailpipe emissions. A study evaluating the impact of the California Air Resources Board (CARB) tailpipe emissions standards policy determined that if the raised emissions standards from CARB that are currently in place in 15 states were implemented nationwide, transportation emissions would have been reduced by 281.7 million metric tons (MMT) in 2015 alone.⁴⁸ This would be nearly 26 percent of transportation emissions, based on the most recent annual estimates of the U.S. transportation sector having emitted 1,091 MMT of carbon dioxide from the U.S. Energy Information Administration (EIA).⁴⁹

Further, a 2017 study carried out by the International Council on Clean Transportation (ICCT) found that when the Secretary of Environment and Natural Resource in Mexico adopted a standardized set of mandatory raised emissions standards in 2013, average carbon dioxide emissions decreased 10 percent by 2016, and is expected to be reduced an additional 28 percent from 2016 standards by 2025 under Phase 2 of the increased emissions standards.⁵⁰ Raising emissions standards has also shown to be both efficient and operationally feasible, as reflected in the Corporate Average Fuel Economy (CAFE) standards that have been in place and retained since 1975, and were bolstered under the Obama administration from 2012–2016, while setting additional targeted raises in emissions from 2017–2025.⁵¹

Emissions standards are relatively politically feasible, as public opinion polling has shown that Americans increasingly perceive increasing air pollution and the effects of climate change to be a significant risk that must be minimized.⁵² However, the Trump administration has sought to put a freeze on the emissions standards implemented during the previous administration during the Obama presidency, and the EPA has determined that the emissions standards

48. Jaewon Lim & DooHwan Won, 2019. *Impact of CARB's Tailpipe Emission Standard Policy on CO2 Reduction among the U.S. States*, 11 SUSTAINABILITY 11 (2019).

49. U.S. Energy Information Administration, *How Much Carbon Dioxide Is Produced From U.S. Gasoline and Diesel Fuel Consumption?* (last updated May 20, 2020), <https://www.eia.gov/tools/faqs/faq.php?id=307&t=10#:~:text=The%20U.S.%20Energy%20Information%20Administration,a%20total%20of%201%2C546%20MMmt>.

50. Francisco Posada et al., Int'l Council on Clean Transp... New Vehicle Fuel Economy and CO2 Emission Standards Emissions Evaluation Guide 29 (2017), https://www.changing-transport.org/wp-content/uploads/2017_FES_GHG_Evaluation_Guide.pdf.

51. See The White House: Office of the Press Secretary, *supra* note 15.

52. See Matthew Ballewet et al., *Climate Change in the American Mind: Data, Tools, and Trends* (Apr. 17, 2019), <https://climatecommunication.yale.edu/publications/climate-change-in-the-american-mind-data-tools-and-trends/>.

set during the Obama administration were too strict—so new, looser emissions standards are expected to be established.⁵³ Raised emissions standards are, in whole, moderately socially equitable, as the percentage of income for emissions fees remains low and approximately equal for consumers of all income groups (although low-income drivers may still face disproportionate burdens).⁵⁴ Additionally, passenger vehicles designed under increased emissions standards have been shown to concurrently increase vehicle safety for consumers.⁵⁵

Financial costs of raising emissions standards is moderate, but comparatively low in the long run. Moderate costs in the short-term are imposed particularly on vehicle manufacturers, as they must invest in increased technological and design improvements to reduce average emissions from manufactured vehicles.⁵⁶ Automakers are generally in favor of looser regulation of passenger vehicle emissions, citing the cost of research and development, as well as production, increases that result from raised emissions standards, which will be passed on to customers.⁵⁷ Raises in passenger vehicles emissions standards in turn reduce fuel costs for drivers, with research showing that a passenger vehicles meeting the 2025 CAFE standards would save an expected \$1,583 per year for each individual vehicle owner in comparison to 2016 emissions standards levels.⁵⁸ Emissions control system improvement costs per vehicle have been shown to be approximately \$600–\$1,200 per vehicle, reflecting that the consumer discount on fuel savings from passenger vehicles following raised emissions standards would be expected to break even in under one year and provide increased financial savings over time.⁵⁹

D. Alternative Fuel Vehicle Subsidies

Subsidies for alternative fuel vehicles are effective in reducing passenger vehicle emissions. Battery-powered electric vehicles (BEV) produce no tailpipe

53. *Regulations for Emissions from Vehicles and Engines: The Safer Affordable Fuel Efficient (SAFE) Vehicles Proposed Rule for Model Years 2021-2026*, U.S. ENVTL. PROT. AGENCY, <https://www.epa.gov/regulations-emissions-vehicles-and-engines/safer-affordable-fuel-efficient-safe-vehicles-proposed> (last visited Sept. 27, 2020).

54. Lisa Schweitzer, *The Empirical Research on the Social Equity of Gas Taxes, Emissions Fees, and Congestion Charges*, 7 (2009), <http://onlinepubs.trb.org/onlinepubs/sr/sr303Schweitzer.pdf>.

55. BETHANY DAVIS NOLL ET AL., INST. FOR POLICY INTEGRITY, ANALYZING EPA'S VEHICLE-EMISSIONS DECISIONS ii (2018), https://policyintegrity.org/files/publications/Analyzing_EPAs_Fuel-Efficiency_Decisions_Policy_Brief.pdf.

56. International Monetary Fund, *The Economic of Climate Change*, 56 FIN. & DEV. (2019), <https://www.imf.org/external/pubs/ft/fandd/2019/12/pdf/fd1219.pdf>.

57. *EPA To Ease Back Emissions Standards*, ASSOCIATED PRESS (Apr. 2, 2018), <https://www.apnews.com/15263ac4791b4378a1ce1e2c4ae2c4b5>.

58. Sean P. McAlinden et al., Ctr. for Auto. Research *The Potential Effects of the 2017-2025 EPA/NHTSA GHG/Fuel Economy Mandates on the U.S. Economy* 20 (2016), <http://www.cargroup.org/wp-content/uploads/2017/02/The-Potential-Effects-of-the-2017-2025-EPANHTSA-GHGFuel-Economy-Mandates-on-the-US-Economy.pdf>.

59. Belinda Chen et al., *Analysis of Auto Industry and Consumer Response to Regulations and Technological Change, and Customization of Consumer Response Models in Support of AB 1493 Rulemaking* 12 (2004), <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.137.8340&rep=rep1&type=pdf>.

emissions, and produce less than half the level of carbon dioxide emissions as traditional fuel vehicles even after taking into account emissions from electrical power generation.⁶⁰ The climate benefits of subsidizing alternative fuel vehicles such as battery-powered electric, plug-in hybrid, and fuel cell electric hybrid vehicles to create an on-road percentage of these vehicles totaling 65 percent would create a 90 percent reduction in emissions that create ozone and particulate matter and a 50 percent decrease in GHG emissions by 2050 in comparison to 2015 levels.⁶¹

It is additionally both efficient and operationally feasible to implement alternative fuel vehicles subsidies on the federal level through programs such as tax credits, incentives, and grants, and can be directed at manufacturers and consumers.⁶² Manufacturers can be eligible for subsidies in the form of grants and loans to re-equip existing production facilities or create new facilities for manufacturing a greater fleet of alternative fuel vehicles.⁶³ A federal loan program is already in place to provide loans for up to 30 percent of costs and reduce vehicle emissions at least 25 percent from 2005 standards in each vehicle produced.⁶⁴ Since 2007, the loan program has invested over \$8 billion in American passenger vehicles manufacturing, primarily used to fund development of fully-electric vehicles that produce no tailpipe emissions.⁶⁵

Alternative fuel vehicles subsidies are also a practical policy for socially equitable reduction of passenger vehicles emissions. Reducing the cost of alternative fuel passenger vehicles not only will increase purchases of these vehicles by higher-earning consumers, but may also increase the ability of lower-earning consumers to purchase and maintain more environmentally-friendly vehicles.⁶⁶ Additionally, federal affordable financing programs for low-income individuals and households can provide particular social benefits. The Clean Vehicle Assistance Program in California is an example of a similar policy at the state level, which secures grants between \$2,500 and \$5,000 for hybrid and electric passenger vehicles, and also secures fair financing on vehicle loans for the remaining cost.⁶⁷

60. *Fact Sheet - Plug-in Electric Vehicles*, ENVTL. & ENERGY STUDY INST. (Aug. 8, 2017), <https://www.eesi.org/papers/view/fact-sheet-plug-in-electric-vehicles-2017#6>.

61. Bonnie Holmes-Gen & Will Barrett, American Heart Ass'n, *Clean Air Future: Health and Climate Benefits of Zero Emissions Vehicles* 13 (2016), <https://www.lung.org/local-content/california/documents/2016zeroemissions.pdf>.

62. *See, e.g.*, CONNECTICUT GREEN BANK, *MOVING FORWARD WITH GREEN ENERGY* (2016), <https://www.ctgreenbank.com/wp-content/uploads/2016/03/CTGreenBank-Market-Potential-Assessment-Alternative-Fuel-Vehicles.pdf>.

63. *See, e.g.*, *Federal Laws and Incentives*, U.S. DEP'T. OF ENERGY, https://afdc.energy.gov/laws/fed_summary (last visited Sept. 27, 2020).

64. 42 U.S.C. § 17013.

65. *Advanced Technology Vehicles Manufacturing Loan Program Manufacturing*, U.S. DEP'T. OF ENERGY, <https://www.energy.gov/lpo/atvm> (last visited Sept. 27, 2020).

66. *Electric Vehicle Benefits and Considerations*, U.S. DEP'T. OF ENERGY, https://afdc.energy.gov/fuels/electricity_benefits.html (last visited Sept. 27, 2020).

67. *Process*, CLEAN VEHICLE ASSISTANCE PROGRAM, <https://cleanvehiclegrants.org/process/>.

Politically, alternative fuel vehicle subsidies remain moderately feasible, as many consumers are increasingly concerned about environmental pollution. Electric vehicle ownership rose 375 percent in the United States between 2013 and 2017.⁶⁸ A section of the citizen population and political officials in the United States may be resistant to alternative vehicle subsidies. Research Professor at the University of Michigan Energy Institute, John Decicco, has argued that alternative fuel vehicle subsidies promote politically favored fuels, and it is inconclusive that alternative fuels minimize climate change.⁶⁹ The Trump administration has been particularly skeptical of overall pushes for increased renewable energy assistance, with White House economic adviser Larry Kudlow contending that the administration is seeking to end all subsidies for alternative fuel vehicles and other renewable energy sources.⁷⁰ As a result, increased federal alternative fuel vehicle subsidies remain politically feasible, but do not yet appear to have conclusive support in the Trump administration.

E. Congestion Charging Zones

Congestion charging zones are the least effective at reducing passenger vehicles emissions of the policy alternatives analyzed in this paper. Since congestion charging zones require high-traffic areas to decrease congestion and vehicle emissions, federal policies for expansion of these zones would not target expansive rural and suburban areas of the country in which tens of millions of Americans live and drive passenger vehicles on a regular basis. This is reflected in the current implementation of these zones at the local level in highly populated and densely developed cities such as New York City, London, and Stockholm. Congestion charging zones have been shown, however, to be particularly socially equitable, as urban areas with public transportation networks allow for individuals of all income levels to take public transportation to jobs and home, allowing vehicles driven in congested urban areas to be a luxury, while fees collected from the congestion charging zones can be redistributed to improve public transportation.⁷¹

Congestion zones are the most fiscally-efficient to implement, as fees from congestion charging zones provide a significant source of revenue for public operating budgets, while implementation costs remain relatively low. In New York City, the implementation of congestion charging zones is expected to cost \$240 million annually, while bringing in a revenue of \$620 million, resulting in

68. International Energy Agency, *Electric Vehicles: Tracking Clean Energy Progress* (2018), <https://www.iea.org/topics/tracking-clean-energy-progress> (last visited Sept. 27, 2020).

69. See generally John Decicco, *Why Pushing Alternate Fuels Make for Bad Public Policy*, YALE ENV'T 360 (Aug. 22, 2013), https://e360.yale.edu/features/why_pushing_alternate_fuels_makes_for_bad_public_policy.

70. Doina Chiacu, *White House Seeks To End Subsidies for Electric Cars, Renewables*, REUTERS (Dec. 3, 2018), <https://www.reuters.com/article/us-usa-trump-autos/white-house-seeks-to-end-subsidies-for-electric-cars-renewables-idUSKBN1O22D4>.

71. See Fix NYC Advisory Panel at 22, *supra* note 36.

a net income of \$380 million a year.⁷² CCZs would be relatively operationally efficient and feasible to implement and maintain, given that capital funding is in place to address implementation needs. While upfront capital costs can prove to be relatively high, totaling hundreds of millions of dollars in infrastructure costs for individual cities, development can be effectively carried out and continued fee revenue allows for sustained maintenance.⁷³

Congestion pricing is politically popular in general in urban areas, with mixed-perspectives in the statewide perspective. New York City residents responded strongly in favor of congestion pricing in a poll conducted by Siena College, with all boroughs polled showing support for congestion pricing ranging from 54.8 to 60.6 percent and opposition between only 32.5 and 39.9 percent.⁷⁴ In a statewide Siena poll of New York residents, however, respondents opposed congestion charging by a margin of 44-41, with Democrats strongly in favor, but Republican and Independent respondents heavily opposed.⁷⁵ As a result, one might expect that congestion charging zones would be highly politically feasible for urban areas with local support, but less feasible under state or federal oversight.

IV. RECOMMENDATION

After assessing possible policy alternatives to reducing passenger vehicles emissions in the United States, I recommended that federal measures to raise passenger vehicles emissions standards alongside increased subsidies for alternative fuel vehicles is the strongest path forward for passenger vehicle emissions reductions. Both higher emissions standards and alternative fuel vehicle subsidies have shown to be particularly effective in reducing passenger vehicle emissions rates, as phased increases in emissions standards have been extensively shown to reduce emissions rates a substantial amount, while alternative fuel vehicle subsidies have allowed manufacturers and consumers to produce and purchase hundreds of thousands of vehicles that produce significantly fewer emissions, just over the past five years. Additionally, these programs can be efficiently implemented, with the ability for policies and funding to be planned for years in the future. For example, standards levels and

72. THE CITY OF NEW YORK, NEW YORK CITY MOBILITY NEEDS ASSESSMENT 2007-2030 (2007), https://web.archive.org/web/20070612050240/http://www.nyc.gov/html/planyc2030/downloads/pdf/tech_report_transportation.pdf.

73. TRI-STATE TRANSP. CAMPAIGN, ROAD PRICING IN LONDON, STOCKHOLM AND SINGAPORE (2017), http://nyc.streetsblog.org/wp-content/uploads/2018/01/TSTC_A_Way_Forward_CPreport_1.4.18_medium.pdf.

74. Gersh Kuntzman, *Poll: City Support for Congestion Pricing Is Even Stronger Than Statewide*, STREETS BLOG NYC (Jan. 17, 2019), <https://nyc.streetsblog.org/2019/01/17/poll-city-support-for-congestion-pricing-is-even-stronger-than-statewide/>.

75. Siena College Research Institute, *Voters Strongly Say Permanent Property Tax Cap & Plastic Bag Ban Are Good for NY*. (Apr. 16, 2019), <https://scri.siena.edu/2019/04/16/voters-strongly-say-permanent-property-tax-cap-plastic-bag-ban-are-good-for-ny/>.

grant funding could be set for target dates under the existing CAFE and AFIG programs.

Raised emissions standards and vehicle subsidies can further be socially equitable, as subsidies can allow for lower income individuals and families to access the ability to purchase electric and hybrid vehicles, while raised emissions standards assist in public health for the entire populace and have been shown to be safer for drivers.

Political support, while not unanimous for either program, is generally popular, and a significant portion of the population in the United States favors alternative energy sources and the reduction of dependence upon and emission of fossil fuels.⁷⁶

While there are a variety of benefits to congestion charging zones, such as cost-effectiveness, strength of social equity, and reduction of emissions in urban areas, I suggest that policies pertaining to congestion charging zones remain under the purview of city officials and residents, as these local governments are able to more practically and effectively introduce and respond to their individual needs for reducing congestion and pollution of passenger vehicles. Because of the need to address issues of growing emissions levels and air pollution, I do not recommend allowing present trends to continue.

CONCLUSION

With GHG emissions and atmospheric concentrations of harmful chemical particles continuing to increase, it is imperative today that destructive social and economic tendencies of allowing these levels of pollution to occur must be halted and reversed. The federal government must reduce the emissions levels of passenger vehicles in the United States.

Three of the most prominent policy options for passenger vehicle emissions reductions are raising passenger vehicle emissions standards, increasing subsidies for alternative fuel vehicles, and implementing congestion charging zones. After considering effectiveness, efficiency, social equity, financial cost, and organizational and political feasibility, I suggest that a combination of increased passenger vehicle emissions standards and subsidies for alternative fuel vehicles should be implemented. Putting these policy programs in place would not only be feasible, but would also be effective and efficient at addressing the goal of reducing passenger vehicle emissions in the United States in a socially equitable manner. These policy steps could play an important part in combatting climate change.

76. See Brian Kennedy, *Two-Thirds of Americans Give Priority to Developing Alternative Energy Over Fossil Fuels*, PEW RESEARCH CTR. (Jan. 23, 2017), <https://www.pewresearch.org/fact-tank/2017/01/23/two-thirds-of-americans-give-priority-to-developing-alternative-energy-over-fossil-fuels/>.