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Priorities in Mitigating Emissions from the Transportation Sector and in Adapting Transportation Facilities

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PRIORITIES IN MITIGATING EMISSIONS FROM THE TRANSPORTATION SECTOR AND IN ADAPTING TRANSPORTATION FACILITIES TO CLIMATE CHANGE*

*Emil H. Frankel***

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INTRODUCTION

This is a response to the Article by Vicki Arroyo, the founder and Executive Director of the Georgetown Climate Center, and her colleagues on new strategies by federal, state, and local governments to achieve a low-carbon and resilient transportation system (the “Article”). Both the Article and this response recognize that the most significant progress made in reducing the transportation sector’s oil dependence and in mitigating greenhouse gas (“GHG”) emissions has resulted from the adoption and implementation by the federal government, beginning in the 1970s, of fuel efficiency standards under the Corporate Average Fuel Efficiency (“CAFE”) program. While federal fuel efficiency standards remained largely unchanged through the 1980s and 1990s, activity resumed during the administration of George W. Bush, and fuel efficiency standards were greatly strengthened and expanded under President Barack Obama. With

* A response to Vicki Arroyo, Kathryn A. Zyla & Gabe Pacyniak, *New Strategies for Reducing Transportation Emissions and Preparing for Climate Impact*, 44 *FORDHAM URB. L.J.* 919 (2017).

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the change of administrations, however, future progress in improving fuel efficiency and in reducing GHG emissions under this program is now uncertain.

Despite the demonstrated effectiveness of fuel efficiency standards, this response emphasizes that pricing also plays an important role in the effort to mitigate GHG emissions and to reduce oil dependence in the transportation sector. Higher fuel prices, particularly, when combined with more rigorous fuel efficiency standards, are the most effective tool to reduce the use of liquid petroleum in transportation and to incentivize technological innovations to improve fuel efficiency. Higher prices reinforce public support for, and acceptance of, increased regulatory requirements for fuel efficiency. Unlike the Article, this response views pricing as a more significant way to achieve these public purposes than the dissemination of zero-emission vehicles.

Further, this response, like the Article, regards the incorporation of GHG emission goals in state and metropolitan transportation planning processes as an important element of a program to reduce those impacts, but calls for specific federal incentives and requirements to achieve these changes. Finally, both the Article and this response acknowledge the growing importance of introducing resilience as an element of transportation planning and investment in light of the impacts of climate change on these facilities that are already occurring and that are likely to grow in the next few years.

I. CLIMATE CHANGE, TRANSPORTATION, AND FUEL EFFICIENCY

As the Article notes, addressing GHG emissions from the transportation sector is critically important to achieving overall national emission reduction goals now contained in the Paris Agreement.¹ Emissions from the transportation sector are now the largest of any sector of the American economy.² However, reducing GHG emissions in transportation has been, and will continue to be, particularly difficult and complicated.

Over the last century, particularly since the end of the Second World War, America has become a society almost totally dependent on the automobile and on the liquid petroleum that enables our auto-

1. Vicki Arroyo et al., *New Strategies for Reducing Transportation Emissions and Preparing for Climate Impact*, 44 FORDHAM URB. L.J. 919, 920.

2. *Id.* at 920.

mobility.³ Oil dependency carries with it serious risks for economic stability, national security, and environmental sustainability.⁴

For all intents and purposes, transportation is the only major sector of the American economy that remains almost totally dependent on oil.⁵ Approximately two-thirds of the liquid petroleum used annually in the United States is used in transportation.⁶ The result is that, without oil, America's transportation system and its economy would come to a halt.

Nonetheless, the country has made progress in reducing GHG emissions from, and in achieving a lower-carbon regime in, the transportation sector. In pursuit of that goal, the most important step taken by the federal government has been the adoption and implementation of fuel efficiency standards under the CAFE program, originally enacted in the 1970s under the pressure of the Organization of the Petroleum Exporting Countries' ("OPEC") oil embargoes.⁷

In its first years, significant savings were achieved from the light-duty vehicle fleet—passenger cars—largely by reducing the weight of automobiles.⁸ But then the CAFE program, under pressure from American automobile companies and automobile workers—and their bipartisan representatives in Congress—went into an almost three-decade period of stagnation.⁹

3. See *Policy Options for Researching Energy Use and Green House Gas Emissions from U.S. Transportation*, SPECIAL REP. 307 (Transp. Res. Bd. of the Nat'l Acad., Wash., D.C.), 2011, at 24, 45-46 [hereinafter TRB SPECIAL REPORT 307].

4. See Rebecca Lefton & Daniel J. Weiss, *Oil Dependence Is a Dangerous Habit*, CTR. FOR AM. PROGRESS (Jan. 13, 2010, 9:00 AM), <https://www.americanprogress.org/issues/green/reports/2010/01/13/7200/oil-dependence-is-a-dangerous-habit/> [https://perma.cc/J7CU-WT4D].

5. TRB SPECIAL REPORT 307, *supra* note 3, at 22, 24.

6. *Id.* at 24.

7. See, e.g., Ryan Balis, *CAFE Standards Kill: Congress' Regulatory Solution to Foreign Oil Dependence Comes at a Steep Price*, NAT'L POL'Y ANALYSIS (July 2006), at 546.

8. See U.S. GEN. ACCOUN. OFF., GAO/RCED-00-194, AUTOMOBILE FUEL ECONOMY: POTENTIAL EFFECTS OF INCREASING THE CORPORATE AVERAGE FUEL ECONOMY STANDARDS (2000); see also *History of Fuel Economy*, CLEAN ENERGY, Apr. 2011, at 2 ("Domestic automakers predicted that fuel economy improvements would require a fleet primarily of subcompacts. In 1974, a Ford executive testified that the standards could 'result in a Ford Product line consisting . . . of all sub-Pinto vehicles.'") (quoting Ford Motor Co.: *Hearing on S.B. 1903, Hearing on Energy Conservation Working Paper Before the S. Comm. on Commerce*, 93rd Cong., 2d Session); TRB SPECIAL REPORT 307, *supra* note 3, at 18, 57.

9. TRB SPECIAL REPORT 307, *supra* note 3, at 5.

George W. Bush's second administration renewed implementation of the CAFE program, reforming and gradually increasing standards for fuel efficiency regulations, and initiating the process to extend fuel efficiency standards to both light- and heavy-duty trucks.¹⁰ During the same period, the 2007 decision of the United States Supreme Court in *Massachusetts v. EPA* made the provisions of the Clean Air Act applicable to GHG emissions from automobiles.¹¹ Since *Massachusetts*, fuel efficiency and GHG emission standards have been jointly regulated by the National Highway Traffic Safety Administration ("NHTSA"), an agency of the U.S. Department of Transportation ("US DOT"), and the U.S. Environmental Protection Agency ("EPA").¹²

The Bush administration's initial steps to establish fuel economy standards and the Obama administration's subsequent higher fuel efficiency standards have been the most significant federal government actions to reduce America's GHG emissions and mitigate the nation's impact on global warming and climate change. Under President Obama, CAFE will require that, by 2025, average miles per gallon for light-duty vehicles exceed fifty-four miles, and heavy-duty trucks will, for the first time, face enforceable fuel efficiency standards.¹³

There is little question that the increasing CAFE standards promulgated for light-duty vehicles under President Bush and for light trucks, SUVs, and heavy-duty trucks under President Obama, have stimulated innovation and will continue to do so. Unlike the early years of CAFE, when automobile manufacturers sought to meet fuel efficiency standards primarily by reducing the weight of light-duty vehicles—with sometimes unfortunate safety consequences—the re-invigorated fuel efficiency regime has stimulated automobile manufacturers to use innovations already in vehicles, like fuel

10. *Id.*

11. 549 U.S. 497, 528, 532 (2007).

12. *NHTSA and EPA Issue Joint Final Rules for CAFE and Greenhouse Gas (GHG) Emissions for Passenger Cars Built for MY 2017 and Beyond*, (2014) https://www.nhtsa.gov/staticfiles/rulemaking/pdf/cafe/CAFE_2017-25_Fact_Sheet.pdf [<https://perma.cc/97EA-CFUT>].

13. See 40 C.F.R. §§ 9, 22, 85, 86, 600, 1033, 1036, 1037, 1039, 1042, 1043, 1065, 1066, 1068 (2017); 49 C.F.R. §§ 523, 534, 535, 538 (2016); Brian F. Mannix, *The Environmental Protection Agency National Highway Traffic Safety Administration's Proposed Rule: Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles—Phase 2*, GEO. WASH. U. REG. STUD. CTR. (Oct. 1, 2015), https://regulatorystudies.columbian.gwu.edu/sites/regulatorystudies.columbian.gwu.edu/files/downloads/Mannix_EPA-NHTSA-truck-CAFE.pdf [<https://perma.cc/XLV4-DKEJ>].

injection systems, to improve fuel efficiency.¹⁴ Now, in order to achieve fuel efficiency more broadly in their entire vehicle fleet, manufacturers are using new designs and materials for automobiles and implementing increased hybridization and technological innovations to the power train.¹⁵

In many cases, these technologies were developed many years ago by automobile manufacturers and even installed in cars, but had been applied to power, not to fuel efficiency.¹⁶ Thus, there is little reason to doubt that the industry can meet the fuel efficiency and GHG emission standards promulgated by the Obama administration, although the future of those regulations is now uncertain, in light of the change of administrations.

II. FUEL EFFICIENCY STANDARDS AND PRICING

The Article rightfully argues that fuel efficiency standards alone cannot achieve the reductions in GHG emissions that scientists indicate are needed to avoid the most catastrophic effects of global warming and satisfy American commitments under the Paris Agreement.¹⁷ However, the Article overestimates the extent that incentives for the broad introduction of zero-emission vehicles (“ZEVs”), such as all electric or fuel cell vehicles, can achieve these goals. Instead, increases in prices through higher fuel taxes, either independently or together with the imposition of mileage-based user fees, would be stronger and more effective complements to fuel efficiency standards in reducing the use of carbon in the transportation sector and in meeting the nation’s climate change goals.

The broad acceptance of ZEVs will require substantial changes in market behavior and an increase in consumer demand. While the experience in California with ZEVs is promising and instructive, increased national acceptance of these vehicles will almost certainly require dramatic improvements in batteries in order to ease the—

14. Antonio M. Bruto, Kevin D. Roth & Yiwei Wang, *The Impact of CAFE Standards on Innovation in the U.S. Automobile Industry*, 2015 AGRIC. & APPLIED ECON. ASS’N ANN. MEETING (2015).

15. See, e.g., *Vehicle Efficiency*, ENVTL & ENERGY STUD. INST., www.eesi.org/topics/vehicle-efficiency/description [<https://perma.cc/8TD4-BPXG>].

16. Nicholas Lutsey & Daniel Sperling, *Energy Efficiency, Fuel Economy, and Policy Implications*, TRANSP. RES. REC.: J. OF THE TRANSP. RES. BOARD, Jan. 2005, at 16.

17. Arroyo et al., *supra* note 1, at 929.

admittedly, sometimes irrational—concern of drivers about battery range.¹⁸

Certainly, with adequate public support and private initiatives in basic research, progress will come in the invention and broad dissemination of batteries that are more durable and that require less frequent and more long-lasting charging, and of more usable fuel cells in the transportation sector.¹⁹ However, it is unclear whether this research and commercial application will occur soon enough and quickly enough to meet America's promised GHG emission and climate change goals.

The adoption of so-called “clean” vehicles will likely not proceed broadly and rapidly enough to provide the necessary complement to the more rigorous fuel efficiency and GHG emission standards that were promulgated by the Obama administration. However, the implementation of those regulations is now uncertain, considering the change of administrations. Rather than providing incentives for the purchase of clean vehicles, increased fuel and road prices can be more effective complements to rising fuel efficiency standards. Pricing strategies are critical to achieving the goals of reduced use of fossil fuels in, and of lower GHG emissions from, the nation's transportation system.

In 2011, a special committee of the Transportation Research Board of the National Academies (“TRB”) undertook a study called, “Policy Options for Reducing Energy Use and Greenhouse Gas Emissions from U.S. Transportation.”²⁰ The committee, which I chaired and of which Vicki Arroyo was an important member, studied a range of policy alternatives to achieve energy and emissions reductions in this sector. In its report, TRB Special Report 307, the committee noted, “[V]ehicle efficiency standards . . . may be desirable in slowing the rate of growth in energy use and emissions. However, such mode- and vehicle-specific policies will need to be succeeded by policies that can generate much larger systemic responses, such as those produced by energy pricing.”²¹

Effective regulation and realistic pricing are interwoven: fuel efficiency and GHG emission standards can be more effective in

18. Hope Reese, *The Future of Electric Cars: Why the Battery Race Will Define It and Musk Is A Genius*, TECHREPUBLIC (Jan. 27, 2016), <http://www.techrepublic.com/article/the-future-of-electric-cars-why-the-battery-race-will-define-it-and-musk-is-a-genius/> [https://perma.cc/E253-URK2].

19. *Id.*

20. TRB SPECIAL REPORT 307, *supra* note 3.

21. *Id.* at 11.

influencing driving and consumer purchasing behavior when fuel prices reflect real costs.²² Higher fuel prices re-enforce public acceptance of more rigorous fuel efficiency standards, since the dynamics of the marketplace incentivize consumers to purchase more fuel-efficient vehicles. The results of combining regulatory and pricing policies can be lower fuel use, energy savings, and reduced oil dependence.²³

While it may seem surprising to many people, America's road and highway system is underpriced.²⁴ The total cost of a gallon of gasoline in the U.S., which reflects federal and state motor fuels tax rates on top of the base price of fuel, is generally only a third to a half of what drivers pay in other developed nations—even after recent tax increases in several states.²⁵ Consequently, taxes on motor fuels in the U.S. are generally too low to influence driver behavior or to provide “signals” to stimulate more efficient utilization of the transportation system and, perhaps, increased purchases of fuel-efficient vehicles.

Two strategies to establish an effective system of market-based incentives and disincentives are (i) increasing taxes on motor fuels and (ii) instituting a general carbon tax throughout the economy. Combined with a rigorous regulatory regime, fuel pricing that reflects the true costs of driving could lead to substantial reductions in fuel use and GHG emissions.²⁶

The Article correctly observes that taxes on motor fuels in the U.S. are generally too low to adequately support the nation's transportation system.²⁷ As the Article notes, the federal gasoline tax has not been increased since 1993, and it “is no longer sufficient to support the nation's transportation needs.”²⁸ The federal Highway Trust Fund (“HTF”) was established in 1956 as the funding source for the construction of the newly authorized Interstate Highway System; federal motor fuel tax funds were dedicated to the HTF. In the sixty years since its establishment, HTF has also become the source of federal funds for surface transportation projects. However, in the

22. *Id.* at 133-39, 142-43.

23. *Id.* at 152, 174-75.

24. See CONG. BUDGET OFF., APPROACHES TO MAKE FEDERAL HIGHWAY SPENDING MORE PRODUCTIVE 1 (2016).

25. For current comparisons, see GLOBAL PETROL PRICES, <http://www.globalpetrolprices.com> [<https://perma.cc/C4RJ-85N9>].

26. TRB SPECIAL REPORT 307, *supra* note 3, at 174-75.

27. Arroyo et al., *supra* note 1, at 964.

28. *Id.*

past ten or so years, federal motor fuels taxes have been insufficient to fully—or in a timely manner—meet all of HTF’s congressionally-authorized programs and projects. Increasingly, HTF has become dependent on transfers from general funds to remain viable.²⁹ Currently, close to thirty percent of HTF revenues derive from general funds, rather than from user fees, and it seems inevitable that the proportion of HTF revenues from non-user fee sources will continue to grow.³⁰

Under these circumstances, the gasoline tax is no longer serving effectively as a proxy for use of the highway system. Further complicating the problem are projected declines in total gasoline tax revenues, attributable not only to political obstacles to increasing the tax rate, but also to greater vehicle fuel efficiency and the presence of alternative fuels and vehicles.³¹ Therefore, as the Article notes, “new funding models are needed.”³² Increasingly, transportation leaders and advocates are recommending that taxes on motor fuels be augmented, and perhaps eventually replaced, by forms of mileage-based user fees.³³

In the words of Sir Rod Eddington, author of a 2006 report on the economic impact of transportation that was commissioned by the United Kingdom’s Treasury and Department for Transport, “policy should get the prices right.”³⁴ Sir Rod, however, did not argue for increases in the U.K.’s gasoline taxes, but rather for greater utilization of various forms of road pricing or mileage-based user fees to support that nation’s surface transportation system.³⁵ Similarly in the U.S., the 2009 congressionally-authorized National Surface Transportation

29. Letter from Keith Hall, Dir., Cong. Budget Off., to Jim Inhofe, Chairman, Comm. on Env’t & Pub. Works (Sept. 9, 2016) (<https://www.cbo.gov/sites/default/files/114th-congress-2015-2016/costestimate/inhofeletteraugust2016htf.pdf> [<https://perma.cc/FZ9H-AY5H>]).

30. See *The Status of the Highway Trust Fund and Options for Paying For Highway Spending: Hearings Before the Comm. on Ways & Means*, 144th Cong. 4 tbl. 1 (2015) (statement of Deputy Assistant Director Chad Shirley).

31. Arroyo et al., *supra* note 1, at 964-65.

32. *Id.* at 965.

33. See, e.g., NAT’L SURFACE TRANSP. INFRASTRUCTURE FIN. COMM’N, PAYING OUR WAY: A NEW FRAMEWORK FOR TRANSPORTATION FINANCE 193-94 (Feb. 2009), http://libraryarchives.metro.net/DPGTL/finance/2009_paying_our_way.pdf [<https://perma.cc/Y23B-5DJA>] [hereinafter FINANCING COMMISSION REPORT].

34. HM TREASURY, THE EDDINGTON TRANSPORT STUDY, THE CASE FOR ACTION: SIR ROD EDDINGTON’S ADVICE TO GOVERNMENT 7 (Dec. 2006), <http://webarchive.nationalarchives.gov.uk/20090104005813/http://www.dft.gov.uk/162259/187604/206711/executivesummary.pdf> [<https://perma.cc/92YJ-AU96>] [hereinafter EDDINGTON REPORT].

35. *Id.* at 6.

Infrastructure Financing Commission (“Financing Commission”) recommended greater use of mileage-based user fees or vehicle-miles-traveled (“VMT”) charges.³⁶

These funding mechanisms are too complicated and limited in scope to provide a sustainable revenue stream for transportation investment. For example, California’s decision to use the proceeds of its cap-and-trade auction for investment in that state’s high-speed intercity passenger rail project is not a model that other states can readily utilize. Rather, mileage-based user fees, as recommended in the reports of Sir Rod and the Financing Commission, offer more promising and sustainable sources of revenue for capital investments and operating expenses of transportation agencies.³⁷

Such mileage-based user or VMT charges also more directly influence driver behavior and market demand.³⁸ These fees could become a powerful force to reduce motor vehicles’ energy consumption and GHG emissions. Moreover, as the Article notes, mileage-based fees could be designed and structured to encourage fuel efficiency and reduced emissions specifically.³⁹

Due to the considerable political obstacles to introducing mileage-based or VMT charges, tolls, cordon or congestion pricing, or other forms of highway user fees, they will likely emerge at the state level before finding approval at the federal level. In the past quarter century, policymakers have shown comparatively little support for policies aimed at raising the price of energy.⁴⁰ Therefore, the introduction of such user fees will be “bottom-up,” rather than “top-down;” that is, they will be introduced in various states or metropolitan regions and only later adopted at the federal level. The broad adoption of gasoline taxes followed a similar pattern, first introduced in Oregon in the 1920s before spreading to other states and eventually being adopted at the federal level.⁴¹

Some states are already experimenting with mileage-based user charges, VMT fees, and cordon or congestion pricing, and state agencies or authorities are imposing tolls more frequently in

36. See FINANCING COMMISSION REPORT, *supra* note 33.

37. EDDINGTON REPORT, *supra* note 34, at 6, 39-41; FINANCING COMMISSION REPORT, *supra* note 33, at 124-58.

38. EDDINGTON REPORT, *supra* note 34, at 39.

39. Arroyo et al., *supra* note 1, at 967.

40. TRB SPECIAL REPORT 307, *supra* note 3, at 100.

41. See Robert Bradley Jr., *The First Gasoline Tax: Less Than Romantic (Oregon: 1919)*, MASTER RES. (Mar. 19, 2015), <https://www.masterresource.org/public-choice-economics/first-gasoline-tax-oregon-1919/> [https://perma.cc/G4JL-KVHX].

connection with the construction or reconstruction of large new transportation facilities.⁴² The most recent federal surface transportation authorization legislation, Fixing America's Surface Transportation Act ("FAST Act"), enacted in 2015, authorized federal grants to states or groups of states for mileage-based user pilot programs, and expanded the ability to impose tolls on Interstate Highways and other federal-aid facilities.⁴³

For these reasons, as the Eddington Report emphasized, getting the prices right is the most effective complement to fuel efficiency standards in reducing the use of carbon in the transportation sector and meeting the nation's climate change goals.⁴⁴

III. CLIMATE CHANGE AND TRANSPORTATION PLANNING

The Article is right to recommend that transportation planning and decision-making processes incorporate GHG emissions goals.⁴⁵ The transportation planning and capital programming processes at the state and metropolitan levels are desperately in need of significant reform. At a time of scarce public investment resources, it is critically important that state transportation and regional planning agencies possess the analytical resources and political authority to develop and implement strategic and comprehensive investment programs, to prioritize projects and activities, to direct resources to projects that offer the greatest economic, social, and environmental benefits, and to be able to make "wise" investment decisions.

Few state agencies and metropolitan planning organizations ("MPOs") have sufficient geographic reach or human and technical resources to carry out such processes or to make such decisions. There are too many MPOs in the nation (over 400), and in many cases their boundaries have little relationship to the relevant labor markets or commuter sheds.⁴⁶

42. Robert W. Poole, Jr. & Adrian T. Moore, *Ten Reasons Why Per-Mile Tolling Is a Better Highway User Fee than Fuel Taxes*, REASON FOUND. (Feb. 2014), http://reason.org/files/why_tolling_is_better_than_fuel_taxes.pdf [<https://perma.cc/LN Y2-UPGP>]; *Transportation Funding & Financing*, BATIC INST., http://www.financingtransportation.org/funding_financing/funding/local_funding/tolls.aspx [<https://perma.cc/4C3Q-P8HZ>].

43. Fixing America's Surface Transportation Act, Pub. L. No. 114-94, 129 Stat. 1312, 6020 (2015).

44. EDDINGTON REPORT, *supra* note 34, at 6.

45. Arroyo et al., *supra* note 1, at 941-54.

46. Emil Frankel, *MPO Consolidation Is Often Needed*, ENO TRANSP. WKLY. (Aug. 8, 2016), <https://www.enotrans.org/article/mpo-consolidation-often-needed/> [<https://perma.cc/Q45X-ZJEL>].

As was strongly recommended in the 2009 report of the National Transportation Policy Project (“NTPP”) of the Bipartisan Policy Center (“BPC”), a report in which I was involved, national goals and performance metrics should be established for the use and investment of federal transportation dollars to enhance the accountability and effectiveness of the state and metropolitan agencies that are the recipients of such federal grants.⁴⁷

Similar goals must be applied to state and metropolitan areas as well. The reduction of GHG emissions was among the goals that BPC’s NTPP recommended be applied to state and metropolitan capital investment plans and programs.⁴⁸ In 2012, Congress enacted a two-year surface transportation authorization bill, Moving Ahead for Progress in the 21st Century (“MAP-21”).⁴⁹ This legislation contained national goals and directed the US DOT to develop and promulgate performance-based metrics to implement these goals. The goals related to a range of purposes, including congestion reduction, system reliability and performance, and environmental sustainability.⁵⁰ US DOT’s Federal Highway Administration (“FHWA”) was to undertake the regulatory processes and the development of these metrics, which were intended to go beyond the expiration date of MAP-21. As it turned out, MAP-21 was repeatedly extended beyond its expiration date until the FAST Act was enacted in December 2015. The FAST Act maintained FHWA’s responsibilities to develop and issue these (and other) performance-related metrics.⁵¹

Consistent with its statutory authority, FHWA in late 2016 issued metrics for highway system management and performance, including measures related to GHG emissions.⁵² The authorizing legislation contained no penalties or rewards for state transportation agencies and MPOs for the achievement of the nationally promulgated goals and measures, and, therefore, the federal performance goals and

47. See *Performance Driven: A New Vision for U.S. Transportation Policy*, NAT’L TRANSP. POL’Y PROJECT (June 9, 2009), http://cdn.bipartisanpolicy.org/wp-content/uploads/sites/default/files/NTPP%20Report_0.pdf [https://perma.cc/9UBL-5DDQ].

48. *Id.* at 68-69.

49. Moving Ahead for Progress in the 21st Century Act, Pub. L. No. 112-141, 126 Stat. 405 (2012).

50. *Id.*

51. *Fixing America’s Surface Transportation Act or “FAST Act”*, U.S. DEP’T OF TRANSP. (July 2016), <https://www.fhwa.dot.gov/fastact/summary.cfm> [https://perma.cc/6SNS-4DG3].

52. 23 C.F.R. § 490.507 (2017).

metrics were relatively benign in nature. Despite this, the issuance of FHWA's requirement to measure GHG emissions has proved controversial. Some parties have asserted that a requirement that GHG emissions be measured is not authorized by the performance metric provisions of MAP-21 and the FAST Act.⁵³ Accordingly, further federal legislation may be necessary to ensure that the US DOT can require that state transportation agencies and MPOs include the reduction of GHG in their federally-mandated transportation planning processes.

In light of the hurdles at the federal level, actions by various states to include GHG emissions in their transportation planning and capital programming processes, independent of federal requirements, are important. In this regard, California is a model for appropriate actions by other states and, eventually, by the federal government. In 2006, California adopted AB 32, a commitment by the state to reduce GHG emissions.⁵⁴ Two years later, the California legislature enacted the "Sustainable Communities and Climate Protection Act" ("SB 375"), which empowered the California Air Resources Board ("CARB") to establish regional targets for GHG emission reductions.⁵⁵ With a focus on performance goals, CARB provided each of the state's major MPOs flexibility in adopting whatever strategies they believed were best suited to achieve the GHG emission goals; the focus of their plans or strategies was to be on outcomes, not on inputs.⁵⁶

These initiatives by California and several other states show how, as the Article suggests, GHG emission reduction and climate change goals can be incorporated into transportation planning processes in a flexible and non-prescriptive way.⁵⁷ While state legislatures should establish goals and metrics, local communities and regional agencies should have the flexibility to design their own strategies across modes, including land use regulations, taxes and fees, and other operational measures, in order to achieve the goals.

In time, federal transportation legislation should require that MPOs' transportation improvement programs ("TIPs") and state

53. Camille von Kaenel, *Administration Proposes 'Bold' Climate Rule for Highways*, E&E NEWS (Apr. 19, 2016), <http://www.eenews.net/climatewire/stories/1060035855> [<https://perma.cc/W3X5-DYL7>].

54. Global Warming Solutions Act, Assembly Bill 32, 2005-2006 Reg. Sess. (Ca. 2006); 2006 Cal. Stat. 89.

55. Senate Bill 375, 2007-2008 Reg. Sess. (Ca. 2008).

56. See ADAM LIVINGSTON, LEADING THE WAY: POLICIES AND PRACTICES FOR SUSTAINABLE COMMUNITIES STRATEGIES 23 (ClimatePlan, 2016).

57. See Arroyo et al., *supra* note 1, at 952.

TIPs, as well as long-range capital investment programs at both the metropolitan and state levels, include GHG emission reduction goals. While state transportation agencies and MPOs should have flexibility and broad discretion on how to achieve nationally established goals in this area, there should be real consequences (in the form of penalties, bonus incentives, or both) if strategies fail to meet such goals.

IV. TRANSPORTATION AND RESILIENCY

No part of the Article is more important and relevant to current transportation planning than its call to incorporate resilience to climate change into transportation planning and investments.⁵⁸ Resilience and adaptation to climate change is an urgent and pressing matter for transportation leaders in both the public and private sectors. Even if GHG emissions were reduced to zero immediately, the greenhouse gases already in the atmosphere, particularly carbon dioxide, which survives in the atmosphere for centuries, will still noticeably affect climate changes.⁵⁹

It is therefore critical to address the impacts of rising sea levels, of possibly catastrophic storm surges and flooding, and of other weather extremes, including draughts, extended heat waves, and severe rain and snowstorms.⁶⁰ Resilience, as Arroyo and her colleagues advocate, should be institutionalized into transportation investments and decision-making.⁶¹ As the Article notes, design standards for new or rebuilt infrastructure must reflect the realities of a changing climate and the greater possibility for more frequent and much more severe weather and weather-related events. To some degree this is already occurring, as agencies such as FHWA and the Federal Transit Administration (“FTA”) gradually require higher design standards for major transportation projects that receive federal assistance. For example, bridges over navigable waters must be constructed at greater heights and must incorporate other design elements to

58. *See generally id.* at 954-64.

59. *See Frequently Asked Questions About Climate Change*, EPA, <https://www.epa.gov/climatechange/frequently-asked-questions-about-climate-change> [<https://perma.cc/4YSR-GECH>].

60. *Understanding the Link Between Climate Change and Extreme Weather*, EPA, <https://www.epa.gov/climate-change-science/understanding-link-between-climate-change-and-extreme-weather> [<https://perma.cc/E4GB-J4CT>]; Allison Crimmins, *When It Rains, It Pours: The Climate Link Between Extreme Precipitation and Drought*, OUR PLANET, OUR HOME (Nov. 26, 2013), <https://blog.epa.gov/blog/2013/11/when-it-rains-it-pours-the-climate-link-between-extreme-precipitation-and-drought/> [<https://perma.cc/V988-8LFF>].

61. Arroyo et al., *supra* note 1, at 954-58.

enhance the likelihood that these facilities will survive rising sea levels and more severe storm surges.⁶²

Importantly, as a practical matter, although not yet assured by statutory amendments, the Federal Emergency Management Agency (“FEMA”) is allowing transportation facilities damaged or demolished by catastrophic events to be rebuilt to higher and more resilient standards.⁶³ Under prior practice, federal emergency funds could only be used to restore a facility to its condition prior to the event.⁶⁴ Thus, federal authorities allowed the State of Vermont to use emergency funds to rebuild state highways, bridges, and culverts to a higher and more resilient condition after they were swept away in the devastating floods associated with Hurricane Irene in 2011.⁶⁵

While the Article notes many examples of state resilience projects to relocate transportation facilities, protect transportation networks, and retrofit existing assets, these projects are generally very expensive and compete with other new-capacity or “state-of-good-repair” projects for funding in an environment of constrained public investment resources.⁶⁶

The runways of virtually every major commercial airport on the East and Gulf coasts would be under water if sea levels rise a foot or more.⁶⁷ Public funds are needed to protect these facilities with sea walls or similar structures, or to raise the heights of these runways. Many major commuter and intercity rail lines and highways are built along seacoasts or in the floodplains of rivers; the cost of relocating

62. See FED. HIGHWAY ADMIN., U.S. DEP’T OF TRANSP., BUILDING CLIMATE RESILIENT TRANSPORTATION 4, https://www.fhwa.dot.gov/environment/sustainability/resilience/publications/bcrt_brochure.pdf [<https://perma.cc/2NTB-9P7U>].

63. See GEO. CLIMATE CTR., PREPARING OUR COMMUNITIES FOR CLIMATE IMPACTS: RECOMMENDATIONS FOR FEDERAL ACTION 19, 33 (2013).

64. See *id.* at 23.

65. See IRENE RECOVERY OFF., ST. OF VT., IRENE: REFLECTIONS ON WEATHERING THE STORM 31 (2013).

66. See, e.g., Scott Shenk, *State’s New Bridge and Pavement Program Expected to Help Fredericksburg-area Projects*, FREDERICKSBURG.COM (May 20, 2016), http://www.fredericksburg.com/news/transportation/state-s-new-bridge-and-pavement-program-expected-to-help/article_dc574211-f54c-546e-aa7d-8224ba1dbd8e.html [<https://perma.cc/AH3L-YEFG>] (noting that Virginia receives federal funding for state of good repair project to repair highways but that the state does not have “nearly enough money” to take care of other needed transportation projects.).

67. See Andrew Freedman, *U.S. Airports Face Increasing Threat from Rising Seas*, CLIMATE CENT. (June 18, 2013), <http://www.climatecentral.org/news/coastal-us-airports-face-increasing-threat-from-sea-level-rise-16126> [<https://perma.cc/QL9U-Q3XH>].

such facilities inland to higher ground is unknown, but sure to be high.⁶⁸

Further, it is unclear how many of America's major metropolitan regions can protect their subway systems from rising seas and more frequent and severe storm surges, such as those experienced during Superstorm Sandy.⁶⁹ Constructing floodgates and dikes across and around major ports and harbors involves huge costs. Undertaking such projects would necessarily displace others.

Federal, state, and local public officials and transportation leaders face these urgent issues. There are few matters in the transportation sector more important than the resiliency of our infrastructure. We are already living in a world in which climate change is affecting our mobility, accessibility, and economy, and we must plan to meet these real and urgent threats.

As the Article notes, while many states and localities are making progress on creating more resilient transportation infrastructure, the challenge of resiliency is significant and the costs of assuring it are very high.⁷⁰ The Article is correct in its emphasis on the importance, and the urgency, of providing resilient transportation infrastructure and in its proposals for addressing these challenges.

CONCLUSION

As discussed in both the Article and this response, the transportation sector has become the largest source of GHG emissions in the U.S., and transportation GHG emissions must be further reduced if the U.S. is to meet the goals to which the nation committed itself in the Paris Agreement. To that end, current fuel efficiency and emission reduction strategies must be vigorously pursued, and new ones adopted. Over the past few years, significant progress has been achieved in this regard, largely attributable to strengthening the fuel efficiency standards, pursuant to the CAFE program, in the administrations of George W. Bush and, particularly, Barack Obama. However, with the change in administrations, further progress under the CAFE program is uncertain.

68. See U.S. CLIMATE CHANGE SCI. PROGRAM, IMPACTS OF CLIMATE CHANGE AND VARIABILITY ON TRANSPORTATION SYSTEMS AND INFRASTRUCTURE: GULF COAST STUDY, PHASE I 4-10, 4-15 (2008).

69. See Andrew Tangel, *NYC's Subway System, Still Recovering from Sandy, Prepares for Joaquin*, WALL ST. J. (Oct. 1, 2015), <https://www.wsj.com/articles/nycs-subway-system-still-recovering-from-sandy-prepares-for-joaquin-1443729284> [<https://perma.cc/59GY-RQNG>].

70. See Arroyo et al., *supra* note 1, at 962.

In addition to further improvements in the fuel efficiency standards, this response emphasizes the importance of pricing, along with regulation, as a significant tool in reducing the transportation sector's almost total dependence on oil. Pricing has the advantage of stimulating technological innovations to achieve fuel efficiency and influencing consumer demand. Higher prices, through forms of either, or both, taxation and mileage-based user fees, would be more effective in reducing oil dependence and GHG emissions from transportation than the uncertain and speculative development and deployment of ZEVs. The Article and this response to it, however, are in agreement that the introduction of GHG emission goals in the transportation planning process could be an important factor in the nation's climate change goals if appropriate legislative and regulatory measures are adopted.

Whether or not the country is successful in mitigating GHG emissions, many of the most serious impacts of climate change are already unavoidable. The Article and this response agree that methods that work toward more resilient transportation facilities and networks must be incorporated in, and prioritized by, transportation planning and investment. Resilience has become one of our most significant climate change strategies and a significant public purpose for all levels of government.