Good morning, Chairman DeFazio, Ranking Member Graves, and members of the Committee. Thank you for the opportunity to testify today about the steps that states and cities are taking to reduce greenhouse gas pollution from transportation and to make our communities more resilient to the serious consequences of climate change.

Many states and cities are taking bold action to reduce emissions and improve resilience, offering both substantial progress in the fight against climate change and examples of successful action that others could emulate and that the federal government could be helpful in scaling up. However, more action is needed.

I'm Vicki Arroyo and I serve as Executive Director of Georgetown Climate Center, which is based at Georgetown University Law Center. I am also a member of the full-time faculty, serving as a Professor from Practice and as Assistant Dean for Centers and Institutes.

The nonpartisan Georgetown Climate Center was established over ten years ago to serve as a resource to states on issues relating to climate change policy and clean energy and to inform the federal dialogue with the lessons of the states.[1] We work with state and city officials on a bipartisan basis at their request to support their transition to cleaner energy sources in important sectors, including the power sector and transportation, and to prepare for the impacts of a changing climate.

I am also currently Chair of the Executive Committee of the Transportation Research Board of the National Academies of Sciences, and recently chaired TRB's Task Force on Resilience and Sustainability[2] which made recommendations regarding how TRB might incorporate considerations of a changing climate and the role of transportation – and impacts to transportation infrastructure – into its important work.

While I am proud of these roles and affiliations, my comments today are my own.

Given the urgent need to address climate change, it's my privilege to be with you today to share examples of what states and cities are doing to promote cleaner transportation options and to prepare for climate impacts. I hope these examples will help inform your own work.

As the Fourth National Climate Assessment, released in November, describes, the United States is already experiencing serious impacts of climate change—and the risks to communities all across the country are growing rapidly.[3]

---

[1] *About Us*, GEORGETOWN CLIMATE CENTER, https://www.georgetownclimate.org/about-us/index.html (last visited Feb. 19,2019).

[2] *TRB Executive Committee*, NATIONAL ACADEMIES OF SCIENCES ENGINEERING MEDICINE (2019), http://www.trb.org/CommitteeandPanels/ExecutiveCommitteeOverview.aspx.

[3] *Climate Assessment, Volume II: Impacts, Risks, and Adaptation in the United States—Summary Findings*, NATIONAL CLIMATE ASSESSMENT (2018), https://nca2018.globalchange.gov/

These findings, along with those in the 2018 Intergovernmental Panel on Climate Change (IPCC) report, are clear and should be a call to immediate action. Even if we manage to limit planetary warming to just 2 degrees C, the world will still face increased chances of economic and social upheaval from more severe flooding, droughts, heatwaves, and other climate impacts as well as devastating environmental consequences, the IPCC report warns.[4]

The scientific consensus as described in the IPCC Special Report is that countries around the world must rapidly decarbonize their economies, cutting greenhouse gas emissions in half by 2030 and to near zero by 2050.[5]

Yet the current trends are going in the wrong direction. Despite our increasing understanding of the narrowing window to act, U.S. GHG emissions ***increased*** by 3.4% in 2018, according to a January report from the Rhodium Group. Clearly more action is needed.[6]

The encouraging news is that many states and cities have committed to taking action. They are taking steps to reduce emissions through legislation, executive orders, and pledges made in collaborations such as the US Climate Alliance – now covering roughly half the US population and GDP.[7]

In my testimony, I will be focusing on the transportation sector, which is the largest contributor of GHG emissions in the United States,[8] and is already facing significant impacts from climate change.

Federal standards have been important in increasing efficiency and reducing emissions, yet transportation-sector emissions are increasing as more vehicle miles are driven, more freight is transported in trucks, and airline travel continues to grow. Transportation is becoming an increasingly large share of U.S. economy-wide emissions as the power sector decarbonizes as a result of market shifts and policy.[9]

There is an urgent need, therefore, to transition to a low-carbon transportation system. Such a transition would not only reduce emissions and fight climate change, it also would bring additional important benefits, including protecting public health by reducing conventional air pollution, providing more mobility options, and driving innovation and economic growth through policy action and through public and private investment.

---

[4] *Global Warming of 1.5 °C*, IPCC (2018), https://www.ipcc.ch/sr15/

[5] *Id.*; *Climate Assessment, Volume II*, *supra* note 3.

[6] Energy & Climate Staff, *Preliminary US Emissions Estimates for 2018*, RHODIUM GROUP (Jan. 8, 2019), https://rhg.com/research/preliminary-us-emissions-estimates-for-2018/.

[7] *U.S. Climate Alliance Fact Sheet*, UNITED STATES CLIMATE ALLIANCE, https://www.usclimatealliance.org/us-climate-alliance-fact-sheet (last visited Feb. 19, 2019).

[8] *Sources of Greenhouse Gas Emissions*, EPA, https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions (last visited Feb. 19, 2019).

[9] *Transportation Sector Emissions*, EPA, https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions#transportation (last visited Feb. 19, 2019).

State Leadership Reducing Emissions from Transportation:

Fortunately, states and cities in the US are already investing in low-carbon transportation solutions, and innovation by governments and the private sector has created opportunities to enable low-carbon economic growth.

States are enabling the transition to zero-emission, electric transportation—promoting adoption of cleaner vehicles and fuels; developing strategies to improve public transportation while reducing vehicle miles traveled and congestion; and enacting pathways to fund this clean transportation innovation—including by pricing the emissions that cause climate change.[10] Cities across the country are also reducing air pollution and GHGs through land use policies; by increasing transportation options through investments in public transit, bike and pedestrian facilities, and new mobility solutions; and by switching to alternative fuels such as electricity, hydrogen, and natural gas. Many cities are committing to deep decarbonization by transitioning to zero-emission public fleets,[11] including replacing 100 percent of their fossil-fueled buses with electric transit buses.[12]

State Funding for Low-Carbon Transportation Investments

Here are some specific examples:

California's economy-wide cap-and-trade program covers transportation fuels and uses the proceeds generated from selling allowances to invest in transit, electric vehicles, and clean transit buses. It also requires investment in projects serving disadvantaged and underserved communities to ensure that the benefits of this new, low-carbon transportation system are more equitably shared.[13]

Oregon lawmakers are considering adopting an economy-wide cap-and-trade program that could be linked to California's program.[14]

In the Northeast, the Transportation and Climate Initiative of 12 northeast and mid-Atlantic states and the District of Columbia ("TCI") was launched in 2010. Facilitated by our Georgetown Climate Center, TCI has worked to develop the clean energy economy in the region, improve transportation, and reduce carbon emissions in the transportation sector.

Projects over the years have included eliminating barriers to the use of cleaner transportation fuels and technologies; sharing best practices in promoting smart growth; understanding freight

---

[10] CAL. HEALTH & SAFETY CODE § 38566 (West 2017).

[11] *Climate Mayors Electric Vehicle Purchasing Collaborative*, CLIMATE MAYORS (2018), https://driveevfleets.org/.

[12] *Zero Emissions Vehicles*, C40 CITIES, https://www.c40.org/networks/zero-emission-vehicles (last visited Feb. 19, 2019).

[13] *CCI Funded Programs*, CALIFORNIA AIR RESOURCES BOARD (Aug. 31, 2018), https://ww2.arb.ca.gov/our-workprogramscalifornia-climate-investments/cci-funded-programs.

[14] H.B. 2020, 80th Leg. Assemb., Reg. Sess. (Or. 2019).

flows into and through the region to consider ways to enhance efficiency and reduce congestion and air pollution; and even working to defeat a patent troll who tried to inhibit sharing of platforms that provide for real-time information on arrivals of subways and buses.

Since 2012, TCI jurisdictions have explored potential regional policy solutions with analysis that demonstrated the economic benefits of moving to cleaner transportation alternatives. In 2015, the TCI jurisdictions announced plans[15] to work together on potential market-based policies and in 2017[16] began to conduct extensive public outreach.

In 2018, TCI regional outreach engaged 500 diverse stakeholders—including from businesses, local governments, community groups, and NGOs—and over 100 state officials in a series of regional listening sessions, with further outreach through statewide efforts in Massachusetts, New York, and Rhode Island.[17]

Those efforts led to a landmark announcement on December 18th, 2018 by nine states plus DC to work together on a bipartisan basis to design a regional low-carbon transportation policy proposal. The proposed plan would cap and reduce carbon emissions from the combustion of transportation fuels and allow each TCI jurisdiction to invest the proceeds in low-carbon and more resilient transportation infrastructure.[18] This approach is modeled on the successful Regional Greenhouse Gas Initiative (RGGI), which has reduced emissions and generated substantial economic benefits in the region. Analysis of the first ten years of the RGGI program estimates that the program has created a net economic benefit of $4 billion dollars for the participating states, while reducing carbon emissions from the power sector by nearly 50 percent.[19]

We believe that the TCI effort can offer similar large benefits and are proud to support this bipartisan group of states in this important initiative.

---

[15] *Five Northeast States and DC Announce They Will Work Together to Develop Potential Market-Based Policies to Cut Carbon Emissions from Transportation*, TRANSPORTATION & CLIMATE INITIATIVE (Nov. 24, 2015), https://www.transportationandclimate.org/main-menu/five-northeast-states-and-dc-announce-they-will-work-together-develop-potential-market.

[16] *Northeast and Mid-Atlantic States Seek Public Input As They Move Toward a Cleaner Transportation Future*, TRANSPORTATION & CLIMATE INITIATIVE (Nov. 13, 2017), https://www.transportationandclimate.org/northeast-and-mid-atlantic-states-seek-public-input-they-move-toward-cleaner-transportation-future.

[17] *Listening Session Summary Report*, TRANSPORTATION & CLIMATE INITIATIVE (Nov. 13, 2018), https://www.transportationandclimate.org/tci-news-and-updates.

[18] *Nine States and D.C. to Design Regional Approach to Cap Greenhouse Gas Pollution from Transportation,* TRANSPORTATION & CLIMATE INITIATIVE (Dec. 18, 2018), https://www.transportationandclimate.org/nine-states-and-dc-design-regional-approach-cap-greenhouse-gas-pollution-transportation.

[19] *The Economic Impacts of the Regional Greenhouse Gas Initiative on Nine Northeast and Atlantic States*, ANALYSIS GROUP: ECONOMIC, FINANCIAL AND STRATEGY CONSULTANTS (Apr. 17, 2018), https://www.analysisgroup.com/globalassets/uploadedfiles/content/insights/publishing/analysis_group_rggi_report_april_2018.pdf.

TCI states are not alone in working to cut transportation emissions—or in recognizing the importance of sustainable funding sources to support needed investments in low-carbon and more resilient transportation infrastructure.

Other states are exploring mileage-based user fees. The state of Oregon conducted two pilots and has now expanded to launch a permanent voluntary program to charge drivers for road usage.[20] Several other states, including California and Hawaii, are conducting research or pilot programs to assess the feasibility of mileage-based user fees as an alternative or complement to motor fuel taxes.[21]

State Action to Support Electric and Zero-Emission Vehicles:

For many years now, states have been leaders in supporting a transition to zero-emission vehicles that reduce air pollution, improve public health, and cut greenhouse gas emissions. Today this committee is hearing from California, given its leadership. But critical investments and policy support for zero-emission vehicles are underway in states and cities across the country. Indeed, it is becoming more widely recognized that moving from a transportation system entirely dominated by petroleum-fueled vehicles to electric and other zero-emission transportation options can provide significant benefits for both the environment and the economy.

It is important to understand that switching to electric vehicles significantly reduces GHG emissions *even* when emissions from power plants that generate the electricity for the electric vehicles are included. For example, in Oregon, a recent analysis showed that an electric vehicle in 2018 would be the equivalent of a gas car with 94 MPG rating.[22] Even in Missouri, where (as of 2015 data) coal power makes up more than 75 percent of electricity generation,[23] an electric vehicle would be equivalent to a 35 miles per gallon gas vehicle.[24] And of course, the opportunities for emissions reductions from adopting electric vehicles will improve throughout the country as the electricity grid decarbonizes (due to fuel switching and the falling prices of wind and solar power for baseload and peak power generation).[25] As the grid becomes cleaner,

---

[20] *About*, OREGO, http://www.myorego.org/about/ (Feb. 19, 2019).

[21] Susan Handy & Marlon Boarnet, *A Framework for Projecting the Potential Statewide Vehicle Miles Traveled (VMT) Reduction from State-Level Strategies in California*, NATIONAL CENTER FOR SUSTAINABLE TRANSPORTATION (Mar. 2017), https://ncst.ucdavis.edu/wp-content/uploads/2017/03/State-Level-VMT-Strategies-White-Paper_FINAL-03.2017.pdf.

[22] David Reichmuth, *New Data Show Electric Vehicles Continue to Get Cleaner*, UNION OF CONCERNED SCIENTISTS (2018), https://blog.ucsusa.org/dave-reichmuth/new-data-show-electric-vehicles-continue-to-get-cleaner?_ga=2.65610987.430581647.1520949632-566757794.1516988670.

[23] *State Energy Analysis Tool*, Georgetown Climate Center, https://www.georgetownclimate.org/clean-energy/sea.html (last visited Feb. 19, 2019).

[24] Reichmuth, *supra* note 22.

[25] *See, e.g.*, Robert Walton, Utility Dive, Xcel solicitation returns 'incredible' renewable energy, storage bids (January 8, 2018) https://www.utilitydive.com/news/xcel-solicitation-returns-incredible-renewable-energy-

an electric vehicle sold this year will effectively become lower- and lower-emitting throughout its life.

Electric vehicles thus present a very important opportunity for reducing emissions and helping states and cities—along with the United States—reach GHG emission reduction commitments. Eventually—and perhaps within the next decade—electric vehicles will be cheaper to buy and to drive than gas vehicles. However, as is the case with many new technologies, public sector support through research, early deployment, and infrastructure installation will be vital to enabling this market to grow. Continued federal support will be critical in this regard to complement, expand upon, and scale the efforts underway in states throughout the country.

Incentives for Zero-Emission Vehicles:

States across the country are providing incentives to drivers to lower the upfront cost of zero-emission vehicles, including battery electric and hydrogen fuel cell vehicles. Fourteen states currently offer a financial incentive, such as a tax credit, and many electric utilities and local or regional governments offer additional financial or non-monetary incentives to drivers.

Some jurisdictions are exploring "fee-bate" structures—a revenue-neutral incentive mechanism where more polluting vehicles pay a fee inversely proportional to vehicle emissions and lower polluting or zero-emission vehicles receive an incentive or rebate.[26] The District of Columbia will be implementing a version of a fee-bate starting in 2020, at which time the District of Columbia Department of Motor Vehicles will assess vehicle title excise tax based on the fuel efficiency of the vehicle, with vehicles that are more fuel efficient than a benchmark level receiving a discount and vehicles that are less fuel efficient paying an additional amount.[27]

One challenge with reducing emissions from the United States fleet of 250 million passenger vehicles is the long lifecycle of vehicles.[28] The average age of passenger vehicles in operation (as of 2017) was 11.6 years, with many vehicles kept in operation for two decades or more.[29] One way to incentivize the retirement of low-efficiency older vehicles would be for the federal government to develop a scrappage and replacement program designed to reduce vehicle

---

storage-bids/514287/; Hawaiian Electric Company Press Release: "New solar-plus-storage projects set low-price benchmark for renewable energy in Hawaii" (January 3, 2019) https://www.hawaiianelectric.com/new-solar-plus-storage-projects-set-low-price-benchmark-for-renewable-energy-in-hawaii

[26] Natalie Mims & Heidi Hauenstein, *Feebates: A Legislative Option to Encourage Continuous Improvements to Automobile Efficiency*, Rocky Mountain Institute (Feb. 2008), https://www.rmi.org/wp-content/uploads/2017/05/RMI_Document_Repository_Public-Reprts_Feebate_final.pdf.

[27] District of Columbia Code 50-2201.03(j)(1A)).

[28] *Number of U.S. Aircraft, Vehicles, Vessels, and Other Conveyances*, BUREAU OF TRANSPORTATION STATISTICS, https://www.bts.gov/content/number-us-aircraft-vehicles-vessels-and-other-conveyances (last visited Feb. 20, 2019).

[29] Average Age of Automobiles and Trucks in Operation in the United States, BUREAU OF TRANSPORTATION STATISTICS, https://www.bts.gov/content/average-age-automobiles-and-trucks-operation-united-states (last visited Feb. 20, 2019).

emissions. Such a program could learn valuable lessons from the Car Allowance Rebate System or "Cash for Clunkers" program of 2009, which was primarily designed as an economic stimulus, but still resulted in improved fuel economy of the vehicle fleet. A federal program could also learn from the scrap and replace programs implemented by two Air Quality Management Districts in California, which provide significant financial incentives to low-income residents who trade in an inefficient vehicle for zero- or near-zero emission replacement.[30]

Electric Vehicles Charging Along Interstate Corridors:

One area where states are working together is the deployment of fast charging stations along highway corridors. Given "range anxiety" concerns, corridor fast charging is critical to grow the market for electric vehicles. People need to know that they can charge their vehicles, such as my 2018 Chevy Bolt, Bluebell, before they will use the vehicles for long distance trips.

The Pacific Coast states have collaborated since 2011 to develop the West Coast Electric Highway, a network of DC fast charging stations along Interstate 5 and other major roadways.[31] This project was first funded as part of the American Recovery and Reinvestment Act. Since the initial wave of funding, Washington, Oregon, and California have used public-private partnerships and state grant funding to build out EV charging infrastructure along corridors. The West Coast Electric Highway effort is notable for its focus on expanding consumer awareness of EV charging through outreach and branding. The states have shared their lessons with other regions, including states participating in the Transportation and Climate Initiative in this region.

TCI states have worked to develop EV charging infrastructure since the start of the regional partnership, and have collaborated since 2016 on regional interstate corridor planning. The focused effort on corridor planning has included engagement with the Federal Alternative Fuel Corridors Program, including a regional nomination resulting in over 2,500 miles of EV corridors designated by U.S. Federal Highway Administration (FHWA) in the first round of designations.[32]

The Transportation and Climate Initiative has been a valuable forum for electric vehicle corridor planning, due to the leadership of state departments of transportation and given the inherent need to collaborate across state lines to allow residents to travel seamlessly and conveniently between cities, for work, and to tourism destinations. The TCI states have worked together to share best practices, engage with EV charging business and electric utilities, and apply together for grant funding programs.

---

[30] *Clean Cars 4 All*, CALIFORNIA AIR RESOURCES BOARD (Feb. 5, 2019), https://www.arb.ca.gov/msprog/cc4a/cc4a.htm.

[31] *West Coast Electric Highway*, IDAHO NATIONAL LABORATORY: ADVANCED VEHICLES, https://avt.inl.gov/project-type/west-coast-electric-highway (last visited Feb. 19, 2019).

[32] U.S. Department of Transportation Designates Electric Vehicles Corridors in the Transportation and Climate Initiative Region, TRANSPORTATION & CLIMATE INITIATIVE (Nov. 3, 2016), https://www.transportationandclimate.org/us-department-transportation-designates-electric-vehicles-corridors-transportation-and-climate.

The TCI states have also worked together to conduct a regional analysis to identify priority locations for additional EV charging infrastructure investment. The technical analysis—launched in 2018—includes an Excel-based tool that can be used to identify which highway exits may be good candidates for additional charging infrastructure investment, as well as an interactive GIS map that displays fast charging infrastructure along corridors in the region and priority investment locations.[33] This corridor analysis was developed by the Georgetown Climate Center and M.J. Bradley & Associates to support the TCI states and was expanded to include Virginia, which joined TCI in September 2018.

In the inter-mountain west states, another bipartisan coalition of governors from eight states launched the Regional Electric Vehicle Plan for the West, or "REV West," with governors signing an MOU with the goal to promote a network of EV corridors.[34]

Opportunity for Federal Leadership and Support

While state and regional initiatives such as these are important in their own right and as models, the federal government can play a critical role in providing funding to stimulate greater investment in EV fast charging along highway corridors. The FAST Act instructed the U.S. Federal Highway Administration to designate corridors for alternative fuels (including electric vehicles), but did not provide any direct funding for infrastructure investment to support the build-out of designated or pending corridors.[35] Given that electric vehicles are a new technology with limited penetration in the vehicle market, there are very few viable business cases for investment in DC fast charging—particularly along highway corridors—in the absence of some public sector funding to support investment. Nevertheless, significant additional investment in EV fast charging will be needed to provide the minimum level of coverage necessary for the market to mature.[36] Once a minimum level of EV fast charging coverage is in place and EV sales increase, consumer demand for charging will drive private investments. In order to jump-start this critical transition to transportation electrification, targeted public funding is needed.

Potential federal investment could expand on strategic planning efforts underway in states and regional partnerships to ensure that federal funding is strategically invested to grow the market for EVs while spurring economic development and improving transportation. For example, several states, including California, Washington, and New York, have undertaken modeling and

---

[33] The regional EV corridor analysis is publicly available at no cost from Georgetown Climate Center. *EV Corridor Analysis Tool for Northeast and Mid-Atlantic States*, GEORGETOWN CLIMATE CENTER (July 26, 2018), https://www.georgetownclimate.org/articles/ev-corridor-analysis-tool-for-northeast-and-mid-atlantic-states.html.

[34] Regional Electric Vehicle (REV) West Program, U.S. DEPARTMENT OF ENERGY: ENERGY EFFICIENCY & RENEWABLE ENERGY, https://afdc.energy.gov/laws/11874 (last visited Feb. 29, 2019).

[35] 23 U.S.C. § 151 (2015).

[36] Eric Wood, *New EVSE Analytical Tools/Models: Electric Vehicle Infrastructure Projection Tool (EVI-Pro)*, NATIONAL RENEWABLE ENERGY LABORATORY (Jan. 24, 2018), https://www.nrel.gov/docs/fy18osti/70831.pdf.

analysis to better understand which highway corridors have been developed by the private market and which are the highest priorities for public funding to support a comprehensive network of EV charging.[37] One strategy that this committee might consider is targeting investment in EV charging in rural and remote corridor locations which are currently underserved by the private market, as a business and economic development opportunity for those locations that would also provide access to EVs to a wider range of communities.

In addition to strategically targeting geographic locations, a federal funding program could also provide additional public benefits by including requirements or incentives that ensure driver convenience and a robust private market for charging stations. There is an opportunity for such a federal program to incorporate lessons learned and policies from ongoing state efforts. States participating in the multi-state ZEV Task Force have worked to identify policy outcomes that can be achieved through requirements for EV charging stations installed with public funding. For example, states are exploring open payment requirements, to ensure that drivers know how much they will pay for a charge, can easily use a credit card to pay for charging, and are not required to have a charging station network membership. We've all gotten used to driving up to a gas station and knowing that we can pay with a credit card (for example), without the requirement of becoming a member of a fuel provider like Exxon or Shell. But that is not always the case with EV charging, which can create inconvenience and confusion. Similarly, requirements that charging station hardware, software, and network services be inter-operable could create a more flexible business market that allows for innovation and avoids stranded assets. I would encourage Congress to engage with states and U.S. national laboratories considering these issues when developing potential infrastructure funding programs.

Federal Support for Technical Analysis

Federal technical and financial support could also help states and metropolitan planning organizations better identify gaps in EV charging infrastructure. This could include expansion of existing tools, for example the corridor analysis tool built to inform northeast and mid-Atlantic states[38] or the Electric Vehicle Infrastructure Projection (EVI-Pro) tool built by the California Energy Commission and National Renewable Energy Laboratory to assess charging infrastructure needs.[39] The federal government could support a study (using EVI-Pro or other methodology) of specific charging infrastructure needs to support long-distance trips on a

---

[37] *Electric Vehicle Charging Infrastructure*, WASHINGTON STATE DEPARTMENT OF TRANSPORTATION (2019), http://www.wsdot.wa.gov/funding/partners/evib.

[38] *EV Corridor Analysis Tool for Northeast and Mid-Atlantic States, supra* note 33.

[39] *CEC EV Infrastructure Projection (California)*, NATIONAL RENEWABLE ENERGY LABORATORY, https://maps.nrel.gov/cec/?aL=0&bL=cdark&cE=0&lR=0&mC=36.8708321556463%2C-116.345214843750O1&zL=6 (last visited Feb. 19, 2019).

national level. This analysis has already been conducted for California, Colorado, and Columbus, Ohio, through existing programs or partnerships.[40]

Non-financial Policy Opportunities:

Currently the federal Manual on Uniform Traffic Control Devices does not allow state DOTs to easily add an EV charging station logo to specific service (food/fuel/lodging) signs. The current manual is somewhat unclear on this subject, which has been vexing to many state agencies looking to develop EV charging signage guidance.[41] One potential solution would be to create a new category of highway logo (specific service) signs for EV charging. This would improve EV driver convenience and provide a significant consumer awareness benefit. California has already taken this approach, modifying its state manual to create a new category for EV charging station logos, and other states are interested in this issue as well. It is important at a minimum that the federal manual maintain flexibility for states to experiment with the best ways to provide logo signs for electric vehicles as we develop an appropriate federal standard.[42]

Congress might also consider the feasibility and potential benefits and costs of exempting EV charging stations and renewable power installations from federal restrictions on commercial activity in the interstate right-of-way. These restrictions have been identified as a barrier in reports, including the recent Transportation Research Board Report to Congress on the Future of the Interstate Highway report.[43]

Opportunities for Research and Development:

While there are many exciting developments underway that are helping to expand the uses of EVs and other low-carbon transportation options, there are still technical and logistical barriers where federal support of pilot programs, research, or public-private partnerships might be helpful.

As we scale up the use of new transportation fuels and technologies over time, research and pilot deployments can help ensure that federal funds are invested efficiently in projects and technologies that reduce emissions, provide energy security, and stimulate economic growth. Additionally, research programs can effectively identify issues that might arise in the future. For example, the federal government could support additional research into questions on how the different zero-emission or alternative fueling and charging infrastructures complement or interact with one another at individual sites or throughout the transportation system. There is significant investment in hydrogen fueling infrastructure in California and other states, due to

---

[40] Eric Wood, supra note 36.

[41] "*To qualify for a GAS logo sign panel, a business should have:* (1) *Vehicle services including gas and/or alternative fuels, oil, and water;* (2) *Continuous operation at least 16 hours per day, 7 days per week for freeways and expressways, and continuous operation at least 12 hours per day, 7 days per week for conventional roads;* (3) *Modern sanitary facilities and drinking water; and* (4) *Public telephone."* U.S. DEP'T OF TRANSP., MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES § 2J.01.10 (Dec. 2009).

[42] CAL. DEP'T OF TRANSP., MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES § 2J.01 (Nov. 2014).

[43] *Renewing the National Commitment to the Interstate Highway System: A Foundation for the* Future, TRANSPORTATION RESEARCH BOARD (Feb. 6, 2019), http://www.trb.org/Main/Blurbs/178485.aspx.

the significant opportunity for hydrogen to serve as an energy-dense zero-tailpipe emission fuel source for vehicles.[44]

For electric vehicle charging, key questions include the opportunities for managed EV fast charging (e.g., providing options for drivers where the cost and speed of charging vary based on electric grid capacity). A related topic for additional research is the interaction of EV charging with on-site storage to minimize distribution grid impacts. Electrify America and Tesla are making major investments in on-site storage co-located with DC fast charging facilities. This is an area where transportation system research—in conjunction with battery storage research underway at the U.S. Department of Energy and U.S. national laboratories—could prove valuable.

Zero-Emission Electric Transit Buses

Moving beyond passenger vehicles, zero-emission transit buses provide opportunities to expand access to cleaner electric transportation, cutting GHG emissions in addition to the smelly and dangerous fumes that affect riders and communities, including those that have been disproportionately harmed by air pollution.

Cities across the country have added electric buses to transit fleets and made commitments for additional procurements. Electric bus pilots are underway everywhere from Anchorage, Alaska,[45] to Honolulu, Hawaii.[46] Here in the District of Columbia, the District Department of Transportation has added 14 electric buses to its Circulator service, which serves commonly traveled routes in the District and costs only $1 to ride.[47] In Texas, the Dallas Area Rapid Transit is piloting electric buses on its free downtown D-Link route.[48] These cities, and many others, are using phased pilots and early deployment to test this new technology and address any concerns related to bus performance, charging reliability, and operating costs.

Many cities have set ambitious economy-wide GHG emission reduction goals and are increasingly making commitments to fully electrify their transit fleets as a strategy to reduce transportation emissions. For example, Los Angeles, California, has committed to fully electrify

---

[44] California Air Resources Board, California's Hydrogen Transportation Initiatives, https://www.arb.ca.gov/msprog/zevprog/hydrogen/hydrogen.htm (last visited Feb. 20, 2019).

[45] Casey Grove, *Alaska's First Electric Bus for Public Transit Read for Anchorage Streets*, ALASKA PUBLIC MEDIA (Jan. 15, 2018), https://www.alaskapublic.org/2018/01/15/alaskas-first-electric-bus-for-public-transit-ready-for-anchorage-streets/.

[46] Press Release, *Electric Bus Demonstration Showcases Unstainable Ground Transportation Future for Hawaii*, HAWAII.GOV (Apr. 11, 2018), http://hidot.hawaii.gov/highways/electric-bus-demonstration-showcases-sustainable-ground-transportation-future-for-hawaii/.

[47] *New DC Circulator Electric Buses*, CIRCULATOR, https://www.dccirculator.com/new-electric-buses/ (last visited Feb. 20, 2019).

[48] Dana Branham, DART'*S Fleet of Electric Buses Roll Out in Downtown Dallas*, DALLAS NEWS (July 10, 2018), https://www.dallasnews.com/news/transportation/2018/07/10/darts-fleet-electric-buses-roll-downtown-dallas.

its fleet by 2030;[49] the Minneapolis and Saint Paul transit agency in Minnesota has announced a 2040 full electrification goal;[50] and the New York Metropolitan Transit Agency—the largest transit fleet in the United States with more than 5,500 buses—has announced a target of transitioning to a zero-emission fleet by 2040.[51]

While electric transit buses provide significant air quality and GHG reduction benefits, along with lower operating and maintenance costs, transit bus electrification is impeded by the higher upfront purchase cost of electric buses and charging infrastructure, a limited economy of scale in manufacturing, and additional routing and charging requirements for fleet managers and operators.

To offset the higher upfront costs, many states are providing funding to transit agencies to support bus electrification. States such as Colorado, Massachusetts, and Virginia have identified transit bus electrification as a priority for investment with the funding received from the Volkswagen diesel emissions settlement. Rhode Island has already launched early deployments of electric transit buses purchased with VW settlement funding[52] and has prioritized routes that travel through neighborhoods that currently suffer from higher levels of air pollution.[53] While these state investments will help to grow the number of zero-emission buses on the road, the scale of funding distributed to states from the VW settlement—$2.9 billion over ten years, distributed across the 50 states and U.S. territories—will not be sufficient to meet states' clean energy and climate goals.

The U.S. Department of Transportation Federal Transit Administration's Low- or No-Emission ("Low-No") Grant program has been instrumental in providing the funding needed by transit agencies to add zero-emission buses to their fleets. In the 2018 funding period alone, over $80 million in funding was awarded to support 52 electric transit bus projects in 41 states. The projects supported with this funding include electric bus deployment across a range of geographies, from the Philadelphia metro area—where the Southeastern Pennsylvania Transportation Authority (SEPTA) is adding electric buses—to rural Wisconsin, where the Wisconsin Department of Transportation will add electric buses to rural fleets statewide.

---

[49] *Council File: 17-0739*, LA CITY CLERK CONNECT (Nov. 9, 2017), https://cityclerk.lacity.org/lacityclerkconnect/index.cfm?fa=ccfi.viewrecord&cfnumber=17-0739.

[50] *Metro Transit's 100% Electric Bus Fleet Target Is a Big Step*, FRESH ENERGY (Dec. 10, 2018), https://fresh-energy.org/metro-transit-100-percent/.

[51] Phil McKenna, *New York City Aims for All-Electric Bus Fleet by 2040*, INSIDE CLIMATE NEWS (Apr. 26, 2018), https://insideclimatenews.org/news/26042018/nyc-air-pollution-electric-bus-public-transportation-mta-clean-technology

[52] State of Rhode Island Press Release, Raimondo, Congressional Delegation Unveil RIPTA's First Electric Buses (October 22, 2018) https://www.ri.gov/press/view/34479

[53] State of Rhode Island, supra note 52.

The funding also allows transit agencies to innovative and explore different methods of recharging buses—whether at a central depot or in-route—as well as opportunities to power buses with renewable energy. For example, the 2018 FTA funding for Broward County Transit will not only replace aging buses with battery electric buses models, but will also include solar power installation.

Due to the significant interest from cities and transit agencies, demand for electric bus funding from the "Low-No" Grant program far exceeds available funding levels. For fiscal year 2018, Congress appropriated an additional $29.45 million in funding—bringing the total to $84.45 million, but applications from transit agencies still exceeded 6 times the available funds.[54]

Opportunity for Federal Leadership and Support

Electric transit buses are already competitive with diesel buses on a total cost of ownership basis (when including fuel and maintenance costs), and will reach cost parity over the coming years.[55] However, funding support and technical assistance are critical in the near term to offset the higher upfront costs and additional logistical challenges. As the cost of lithium ion battery packs continues to fall, and bus manufacturers increase the scale of production of electric transit buses, costs of buses will continue to decline, and electric transit buses may ultimately provide a lower cost alternative. In the near term, however, additional federal funding for converting combustion engine fleets to zero-emission electric propulsion would provide valuable support to local and state governments.

Zero Emission Ferries and Marine Transport

In addition to electrifying passenger vehicles and transit fleets, states are exploring opportunities for zero-emission marine transport. Washington Governor Jay Inslee announced his Washington Maritime Blue 2050 Initiative in 2017 to create and expand a sustainable ocean industry through the combined use of electric ferries and ships and zero-carbon-emissions port terminals.[56] Washington State plans to use around 45 percent of its VW settlement money to fund the electrification of public vessels, with a particular focus on ferries,

---

[54] "FTA received 149 eligible proposals from 42 states requesting $557 million in Federal funds." U.S. Department of Transportation, Federal Transit Administration, *Fiscal Year 2018 Low or No Emission Grant Program Project Selections*, (October 12, 2018) https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/funding/grants/grant-programs/118881/fy18-low-no-project-selections-and-guidance.pdf

[55] *Electric Buses in Cities: Driving Towards Cleaner Air and Lower CO2*, C40 (Mar. 29, 2018), https://c40-production-images.s3.amazonaws.com/other_uploads/images/1726_BNEF_C40_Electric_buses_in_cities_FINAL_APPROVED_%282%29.original.pdf?1523363881

[56] Tara Lee, *Leading in the Maritime Sector: Washington Launches Maritime Blue 2050 Initiative*, WASHINGTON GOVERNOR JAY INSLEE (Dec. 12, 2017), https://www.governor.wa.gov/news-media/leading-maritime-sector-washington-launches-maritime-blue-2050-initiative.

recognizing that in Washington State, "ferries account for more than half of the air pollution generated by harbor vessels."[57]

Hydrogen fuel cells may provide another viable option for zero-emission marine transport. A study undertaken by Sandia National Laboratories concluded in July 2018 that it is both technologically and economically feasible to build research vessels powered by hydrogen fuel cells.[58] The first commercial ship running on hydrogen and producing zero pollution was built in 2017.[59]

The United States could explore additional international partnerships for research and development and implementation. For example, Norway and Finland have deployed battery-electric ferries, and Norway is currently piloting hydrogen ferries.[60] Norway has passed legislation to make its fjords zero emissions zones by 2026, only allowing electric ships into its waters.[61]

Decarbonizing Medium- and Heavy-Duty Trucks

As the movement of goods on our country's highway corridors continues to increase with the growth of e-commerce, decarbonizing truck transport will be critical to meeting state and national climate commitments. For both long-haul and local delivery by heavy-duty and medium-duty vehicles, a number of low- or zero-emission vehicle and fuel types may serve different use cases.

For reducing emissions of criteria pollutants, natural gas- and propane-fueled vehicles offer a promising and potentially low-cost alternative. For reducing GHG emissions, the federal government could play a key role in enabling the deployment of battery electric and hydrogen fuel cell vehicles.

Many vehicle and engine manufacturers have announced plans to release battery electric trucks over the coming years, and hydrogen truck pilots offer a promising alternative. The U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, has supported

---

[57] The Washington State Plan notes that Converting diesel to all-battery electric ferries will significantly reduce diesel and carbon emissions, improve fleet reliability, virtually eliminate engine noise that can harm marine animals, and reduce ferry operating costs by up to 20%. Brett Rude & Mike Boyer, *State of Washington Volkswagen Beneficiary Mitigation Plan*, DEPARTMENT OF ECOLOGY: STATE OF WASHINGTON (Nov. 2018), https://fortress.wa.gov/ecy/publications/documents/1802023.pdf.

[58] Sandia National Laboratories, Diesel Does*n't Float This Boat—Team Designs Zero-Emission Research Vehicle*, PHYS.ORG (July 2, 2018), https://phys.org/news/2018-07-diesel-doesnt-boatteam-zero-emissions-marine.html.

[59] Anna Hirtenstein, *There's Now Vessel That Produces Zero Pollution*, BLOOMBERG (Nov. 29, 2017), https://www.bloomberg.com/news/articles/2017-11-29/oceans-get-zero-emission-ship-in-step-toward-cleaner-cargo.

[60] Tjalve Magnusson Svedndsen, *The First Hydrogen Ferry in Norway*, CHRISTIAN MICHELSEN RESEARCH, https://www.cmr.no/projects/10568/hydrogen-ferry/ (last visited Feb. 20, 2019).

[61] Fred Lambert, *Norway Is Making Its Fjords 'The World's First Zero Emission Zone at Sea'*, ELECTREK (May 4, 2018), https://electrek.co/2018/05/04/elecitrc-ferries-norway-fjords-worlds-first-zero-emission-zone/.

significant research and development efforts for hydrogen and fuel cell technologies, including through partnerships with U.S. national laboratories and private sector businesses, and has set ambitious goals for reducing the price of hydrogen fuel cells.[62] This investment in hydrogen as a transportation fuel is as part of a broader opportunity role for hydrogen fuel in a decarbonized United State energy system.

One critical challenge for both of these zero-emission technology types is the development of sufficient charging or fueling infrastructure along highway corridors. Similar to passenger vehicles, a minimum level of infrastructure coverage needs to be in place in order for the market to grow to the scale necessary to support private investment and unsubsidized growth.

Heavy duty battery-electric trucks provide unique charging infrastructure and electric grid challenges. For example, the electric semi-truck specifications suggested by Tesla might require over 1 MW capacity charging per plug—equivalent to a Walmart SuperCenter. A truck stop depot with 10 of these chargers could have a peak electrical load similar to an industrial facility, but will often be located in a rural area far from available electrical power capacity.

The federal government could play a critical role expanding research and pilot programs to determine the most cost effective and efficient means of providing this type of vehicle charging, including the role of stationary storage batteries and co-location of renewable power generation. This work could incorporate the freight corridor planning underway in many states through the FHWA Alternative Fuel Corridor program, and could engage key stakeholders, including electric utilities, the National Association of Truck Stop Operators, and vehicle manufacturers.

Reducing Emissions by Providing Greater Mode Choices

In addition to supporting infrastructure to enable a transition to zero- and low-emission vehicles, the federal government can play a key role in reducing the number of vehicle miles traveled by improving transportation efficiency; by promoting more compact, livable communities; and by providing more transportation choices, including public transit, biking and walking. While states generally control land use planning decisions, the federal government has a critical role to play through its administration of transportation funding and infrastructure investment.

Many states are confronting the challenge of reducing air pollution and emissions while experiencing increases in vehicle miles traveled. The Minnesota Pollution Control Agency recently released a report on the state's emissions over the last 25 years and strategies needed to meet the state's greenhouse gas emission reduction targets. The report found that while Minnesota has successfully reduced its overall emissions while growing its economy, the state missed its 2015 emission reduction target; and transportation is now the largest source of emissions in the state. The report suggests that the trends of residents driving more miles and

[62] U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Fuel Cell Technologies Office Accomplishments and Progress, https://www.energy.gov/eere/fuelcells/fuel-cell-technologies-office-accomplishments-and-progress

preferring larger vehicles are preventing a greater reduction of emissions, and suggests that additional transportation mode choices can be an effective strategy for the state moving forward.[63]

State Support for Bicycle and Pedestrian Transportation

There are many examples of state leadership in developing "complete streets" that allow for safe and efficient movement of pedestrians and bicyclists, in addition to vehicles. New Jersey has a nationally recognized complete streets policy that includes significant engagement with counties and municipalities. New Jersey Department of Transportation provides training to its own engineers and planners, along with those from local agencies, on complete streets policies. New Jersey Department of Transportation also provides incentives through its Local Aid and Economic Development grant program to municipalities that meet Complete Streets policy objectives.[64]

Many states' active transit projects are funded through federal programs, including the Capital Investment Grant program, Transportation Alternatives Program, and Surface Transportation Block Grant.

Public Transportation and Transit Oriented Development

Investment in public transit, including light rail systems, bus rapid transit, traditional bus routes, and new mobility applications such as dynamic-routing micro-transit provide additional transportation choices and can stimulate economic development while reducing emissions. Cities and states throughout the U.S. are pioneering innovative ways of making transit more convenient and accessible, while harnessing the benefits of transit for community development and economic growth.

In Dallas, the Dallas Area Rapid Transit (DART) system has introduced the "GoPass," a simple system that allows easy payment for different transit services while allowing frequent users to automatically take advantage of monthly or daily ride discounts when available.[65] The GoPass was originally introduced nearly five years ago. DART introduced both the "cash to mobile" option and fare capping last year. These two items especially help low income populations. Last month, DART introduced GoPass 3.0 which begins to fully integrate other modes into the app, such as micro-transit services and scooters. The entire trip can be paid for on the app rather than bouncing back and forth between apps. This month DART is introducing Uber Pool as

---

[63] Anne Claflin & Fawkes Steinwand, Greenhouse Gas Emissions in Minnesota: 1990-2016 7, MINNESOTA POLLUTION CONTROL AGENCY: DEPARTMENT OF COMMERCE (Jan. 2019), https://www.pca.state.mn.us/sites/default/files/lraq-2sy19.pdf.

[64] *Complete Streets: Workshop and Training*, DEPARTMENT OF TRANSPORTATION, https://www.state.nj.us/transportation/eng/completestreets/training.shtm (last visited Feb. 20, 2019).

[65] When using a GoPass, transit riders "never pay more than the price of a day pass in one day, or the price of a monthly pass in one month" through an automated payment system. Dallas Area Rapid Transit, *GoPass Frequently Asked Questions*. https://www.gopass.org/customer-service/questions-answers

backup to the micro-transit services already offered, to make sure that the response times are maintained.

Arlington, Virginia, where I live has seen significant economic development and population increases over recent decades, but has successfully decoupled this growth from greenhouse gas emissions by implementing transit-oriented development, in which mixed use developments are clustered near Metro stations.[66]

To encourage more cities and regional governments to invest in critical public transit infrastructure, the federal government might consider increasing the federal match for public transit projects, from current levels of 50 percent (compared to 80 percent for road projects funded by the Highway Trust Fund).

Transportation System Resilience

Despite innovation in the transportation sector and a shift to cleaner sources of electricity, including improved vehicles and fuels as a result of federal and state policy, we are already seeing the effects of climate change. Extreme weather events are becoming more frequent and intense, creating new challenges for infrastructure agencies that must consider how to prepare assets for these changing conditions and to do so on very limited budgets.

Since 1980, the U.S. has experienced 241 extreme weather-related events with costs of more than $1 billion. The total estimated cost of these events adds up to more than $1.6 trillion. And the frequency and scale of these major disasters is increasing. Nearly one-third of total costs have come from events in just the past 5 years.[67] In 2017 alone, extreme weather events cost the U.S. over $300 billion, in large part due to Hurricanes Harvey, Irma, and Maria.[68] These disasters have caused significant damages to infrastructure, which in some cases has led to years-long recovery efforts.[69]

---

[66] *Billion Dollar Weather and Climate Disasters: Overview*, NOAA: NATIONAL CENTER FOR ENVIRONMENTAL INFORMATION (2019), https://www.ncdc.noaa.gov/billions/.

[67] NOAA, Billion-Dollar Weather and Climate Disasters.

[68] Chris Mooney & Brady Dennis, Extreme *H*urricanes and *W*ildfires *M*ade 2017 the *M*ost *C*ostly U.S. *Di*saster *Y*ear on *R*ecord, WASHINGTON POST (Jan. 8, 2018) https://www.washingtonpost.com/news/energy-environment/wp/2018/01/08/hurricanes-wildfires-made-2017-the-most-costly-u-s-disaster-year-on-record/.

[69] For example, Vermont experienced an estimated $250-300 million in infrastructure damage resulting from Tropical Storm Irene. Vermont's challenges of rebuilding culverts more resiliently during the recovery period, due to barriers at the time in federal law and disaster recovery programs, is explored in the report. Lessons Learned from Irene: Climate Change, Federal Disaster Relief, and Barriers to Adaptive Reconstruction, GEORGETOWN CLIMATE CENTER (Dec. 20, 2013), https://www.georgetownclimate.org/reports/lessons-learned-from-irene-climate-change-federal-disaster-relief-and-barriers-to-adaptive-reconstruction.html. In New York, the many transportation-related impacts resulting from Hurricane Sandy in 2012, summarized in the report Transportation During and After Sandy, have led to numerous efforts to improve resilience in transportation infrastructure. Sarah Kaufman, et al., *Transportation During and After Hurricane Sandy*, RUDIN CENTER FOR TRANSPORTATION: NYU WAGNER GRADUATE SCHOOL

As many of you know from the communities you represent, the human toll from these events is huge. In 2005, many members of my family, including my mother, sister and brother-in-law, aunt and uncle, lost homes in Katrina. The year before, my father Sidney Arroyo died during a stressful evacuation from Hurricane Ivan. The human and economic toll of these events is staggering. It is vital that we capture lessons on how to improve infrastructure and operations to get people out of harm's way in advance of storms and to build back differently as these events become more common and more severe.

Our work in communities after Hurricanes Katrina, Irene and Sandy demonstrate opportunities to improve how communities rebuild after storms.

What States are Doing

Many states and local governments are learning from recent extreme events and are working to prepare their infrastructure systems for additional impacts of climate change. We are seeing more dedicated funding for resilient investments. Innovative steps include nature-based resilience strategies to help mitigate impacts of flooding and heat, new committees and task forces to examine climate change impacts and to design infrastructure to be more resilient, and new requirements to account for climate change in state or local planning and investments. For example, legislation and voter initiatives in Massachusetts, California, and Miami have committed funding for programs and projects that will build resilience in communities and infrastructure systems. In Massachusetts, state legislation authorized hundreds of millions of dollars for critical infrastructure protection and adaptation, implementation of the state's integrated hazard mitigation and climate adaptation plan, and other state and local resilience measures as part of a $2.4 billion package.[70] Legislation in California (and subsequent voter approval) authorized over $4 billion in bonds for conservation and resilience, parks and recreation, and water projects, including $443 million specifically for climate change preparedness and habitat resiliency, and $550 million for flood protection.[71] And in Miami,

---

OF PUBLIC SERVICE (Nov. 2012), https://wagner.nyu.edu/files/faculty/publications/sandytransportation.pdf. See*, e.g.,* Post Hurricane Sandy Transportation Resilience Study in New York, New Jersey, and Connecticut, U.S. DEPARTMENT OF TRANSPORTATION (Oct. 2017), https://www.fhwa.dot.gov/environment/sustainability/resilience/publications/hurricane_sandy/fhwahep17097.pdf; *Port Authority of New York and New Jersey – PATH System Resiliency and Recovery Improvements*, GEORGETOWN CLIMATE CENTER: ADAPTATION CLEARINGHOUSE (Jan. 16, 2015), https://www.adaptationclearinghouse.org/resources/port-authority-of-new-york-and-new-jersey-path-system-resiliency-and-recovery-improvements.html. In Colorado, severe rains and flooding in September 2013 caused major road damage and wash-outs along US 34, which provides sole access to some areas. Recovery and reconstruction efforts extended into 2018, but resulted in a more resilient design of the highway. *See US 34 Big Thompson Canyon*, COLORADO DEPARTMENT OF TRANSPORTATION, https://www.codot.gov/projects/floodrelatedprojects/us-34-big-thompson-canyon-1 (last visited Feb. 20, 2019).

[70] An act promoting climate change adaptation, environmental and natural resource protection, and investment in recreational assets and opportunity, ch. 209, 2018 Mass. Sess. Laws.

[71] California Drought, Water, Parks, Climate, Coastal Protection, and Outdoor Access For All Act of 2018, Ch. 852, 2017-2018 Cal. Sess. Laws (subsequently approved by voters in June 2018 as Prop. 68).

voters approved a bond package with nearly $200 million for projects to mitigate impacts of sea-level rise and flooding.[72]

States and local governments are also showing commitment to resilience through planning and programs, task forces and studies, and new design requirements and development and zoning regulations. The Louisiana's Strategic Adaptations for Future Environments (LA SAFE) Program, initially funded through disaster recovery dollars in 2012, works with parishes to co-design customized projects and programs that will improve community resilience like "complete streets" and nature-based flood mitigation projects.[73] California's Climate-Safe Infrastructure Working Group, established pursuant to legislation passed in 2016,[74] completed its recommendations in 2018 for how the state can better integrate climate science into engineering and design.[75] New York State established formal statewide sea-level rise projections by regulation in early 2018,[76] implementing an important aspect of the state's Community Risk and Resiliency Act (2014), which is designed to integrate considerations of climate change impacts to proposed projects in certain funding and permitting processes overseen by state agencies.[77] Maryland expanded its "Coast Smart" program in 2018, now requiring that state-funded local projects (in addition to state capital projects) be sited and designed according to the state's "Coast Smart" criteria, which were also updated in 2018 pursuant to the legislation.[78] And a range of local governments in places like Houston, Broward County, and New York City are implementing new floodplain and zoning regulations and design requirements to ensure that infrastructure investments and other development either avoid high-risk areas or are built to withstand future storms and conditions.[79]

---

[72] Adam Aton, Climate funding passes; vulnerable cities get new mayors, E&E NEWS (Nov. 8, 2017), https://www.eenews.net/climatewire/2017/11/08/stories/1060065971.

[73] *Louisiana's Strategic Adaptations for Future Environments*, LA SAFE, https://lasafe.la.gov/ (last visited Feb. 20, 2019).

[74] Climate change: infrastructure planning, ch. 580, 2015-2016 Cal. Sess. Laws.

[75] *Paying It Forward: The Path Toward Climate-Safe Infrastructure in California*, CALIFORNIA NATURAL RESOURCES AGENCY (Sept. 2018), http://resources.ca.gov/climate/climate-safe-infrastructure-working-group/.

[76] NY ENVTL. CONSERV. LAW § 490 (2018).

[77] *New York Community Risk and Resiliency Act (S06617B)*, GEORGETOWN CLIMATE CENTER: ADAPTATION CLEARINGHOUSE (Sept. 22, 2014), https://www.adaptationclearinghouse.org/resources/new-york-community-risk-and-resiliency-act-s06617b.html..

[78] For more information, *see* Georgetown Climate Center, Maryland HB 1350/ SB 1006 - Sea Level Rise Inundation and Coastal Flooding - Construction, Adaptation, and Mitigation.

[79] Houston voted to update its Floodplain Management Ordinance, now regulating new development in the 500-year floodplain instead of just the 100-year. City of Houston, Ord. No. 2018-258 (Apr. 4, 2018). Broward County is now using "future conditions" maps that account for the impacts of sea-level rise on groundwater levels when approving drainage and other water management infrastructure, which will help ensure that infrastructure lasts in the future. Broward Cty., Fla., Ordinance No. 2017-16 (May 23, 2017). In New York City, the Mayor's Office of Recovery and Resiliency developed new Climate Resiliency Design Guidelines to be used in the planning and design of city capital projects.

What Can Congress Do?

In its recent report, the Committee for the Study of the Future Interstate Highway System highlighted the importance of preparing the Interstate Highway System and other roads and bridges for the impacts of climate change and more intense weather events.[80] Congress should act on these recommendations to ensure that major federal infrastructure investments, including but not limited to the Interstate Highway System, are built to withstand flooding, increased heat, and other climate change impacts. Congress can build on steps already taken in MAP-21 and the FAST Act (integrating resilience and risk considerations in transportation planning processes), and in the Disaster Recovery Reform Act (authorizing a set-aside funding source from disaster expenses for pre-disaster mitigation grants for public infrastructure projects that will improve resilience, among other provisions designed to foster long-term resilience as part of disaster recovery).[81] To ensure fiscal responsibility, recipients of federal funding should be required to consider how climate change will impact their infrastructure systems and assets in the future, and ensure that their investments are designed accordingly to withstand future conditions. States should be provided with the tools and information they need to adequately integrate these considerations into capital decision-making processes, and with strong incentives to engage in resilience planning and to modify codes and standards ahead of disasters to facilitate resilient rebuilding when funds are available.[82] It is more important than ever to ensure that federal dollars are spent wisely and not wasted on investments that will not be built to last under future climate conditions and a "new normal" that includes increasingly severe weather events.

In addition to infrastructure, we should understand that resilience to impacts depends on people as well and developing strategies to evacuate safely.

---

[80] National Academies of Sciences, Engineering, and Medicine, *Renewing the National Commitment to the Interstate Highway System: A Foundation for the Future* (2018).

[81] Federal Aviation Administration Reauthorization Act of 2018, H.R. 302, Div. D, 115th Cong. (2018). For example, the DRRA also clarifies that predisaster hazard mitigation funds may be used to establish and implement the latest hazard-resistant designs and criteria (modifying 42 USC 5133(e)), and it adds new evaluation criteria for predisaster hazard mitigation assistance awards, including the extent to which potential grantees have adopted the latest hazard-resistant designs and codes, and "the extent to which the assistance will fund activities that increase the level of resiliency" (modifying 42 USC 5133(g)). It also clarifies that Public Assistance funds can reimburse costs of rebuilding facilities according to "the latest published editions of relevant consensus-based codes, specifications, and standards…" or "in a manner that allows the facility to meet the definition of resilient" (which is to be developed by FEMA rulemaking) (modifying 42 USC 5172(e)).

[82] Standards-setting organizations like the American Society of Civil Engineers have been engaging for several years in discussions about how to modify infrastructure design to account for changing risk profiles as a result of climate change. ASCE's Committee on Adaptation to a Changing Climate recently published a new Manual of Practice with guidance for engineers and others involved in infrastructure decisionmaking to assist with integrating adaptive design and minimizing lifecycle costs given a changing climate. *Climate-Resilient Infrastructure: Adaptive Design and Risk Management*, Committee on Adaptation to a Changing Climate, ASCE; Edited by Bilal M. Ayyub , Ph.D., P.E. 2018.

In Katrina, more than 1800 people who stayed behind died. Some didn't leave because of the difficulty in evacuating the year before during Ivan, Others didn't have affordable options for transportation or shelter, and still others didn't want to leave their pets behind after discovering that public transport and shelter options prohibited animals. Because of those hard lessons, Congress passed the Pet Evacuation and Transportation Standards Act—yes, "PETS"—which no doubt has saved lives of countless pets and people in more recent storms.

New programs like "Evacuteers" in New Orleans have sprung up to make sure people (and pets) can get out of harm's way, and portions of the I-10 twin spans, after sections were knocked out in Katrina, have been elevated.

There is more to be done to prepare our communities for the changes we're experiencing now that will accelerate and worsen over time, even while states and cities work to do their share to tackle the emissions contributing to a changing climate.

Thank you for considering how Congress might support them in these efforts.