



**U.S. Department  
of Transportation**



# Climate Change and Transportation 101:

## Module 3: Transportation Climate Solutions

# Two Types of Transportation Climate Solutions

## Mitigation

- Mitigation: Human intervention to reduce the amount of greenhouse gases in the atmosphere. Helps us make future climate change less severe.
- In transportation, this means reducing greenhouse gas emissions from transportation sources, the largest source being carbon dioxide (CO<sub>2</sub>) from burning fuels to power vehicles.



## Adaptation

- Adaptation: The process of adjusting to current and future climate conditions. Helps us build resilience and minimize destruction and suffering from climate change already locked in.
- Resilience: “the ability to anticipate, prepare for, or adapt to conditions or withstand, respond to, or recover rapidly from disruptions. . . (IIJA Sec. 11103)
- In transportation, this means planning, designing, operating, and maintaining transportation systems to minimize damage and disruption.





# Mitigation: Strategies to Reduce Transportation Emissions

## Convenient



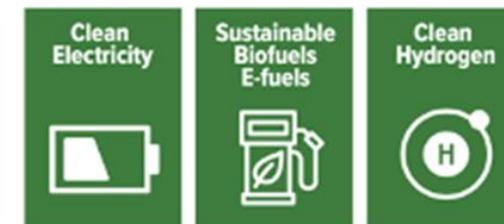
Improve Community Design  
and Land-use Planning

## Efficient



Increase Options to Travel  
More Efficiently

## Clean



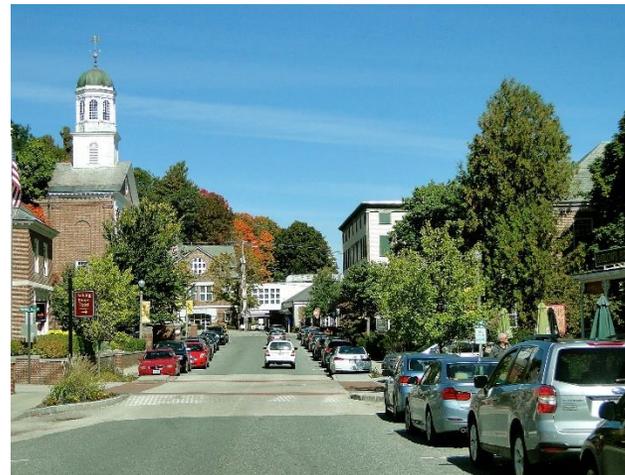
Transition to Zero Emission  
Vehicles and Fuels

# Strategies to Reduce Transportation Emissions

## Convenient: Improve Community Design and Land Use Planning

Projects that increase convenience by supporting community design and land-use planning that make it practical to take fewer or shorter trips. Examples include:

- Integrated land use and transportation plans that ensure jobs, shopping, schools, and services are strategically located near where people live and near public transit.
- Building sidewalks and bike lanes
- Remove minimum parking space requirements
- Prioritize maintaining existing assets before building new assets
- Travel Demand Management – parking pricing and congestion pricing paired with transit options
- Supply chain management and freight efficiency

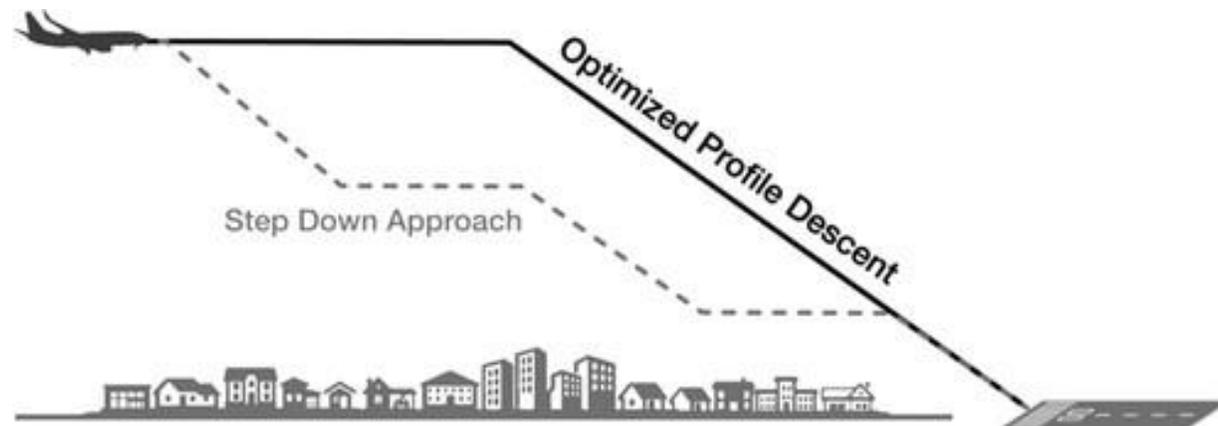


# Strategies to Reduce Transportation Emissions

## Efficient: Increase Options to Travel More Efficiently

Projects that increase options to travel more efficiently and improve the efficiency of vehicles. Examples include:

- Providing high quality public transportation
- Intercity passenger rail and freight rail
- Operational improvements (traffic signal timing, optimized profile descent for aircraft, automatic train control, etc.)
- Improving intermodal freight transfers



# Strategies to Reduce Transportation Emissions

## Clean: Transition to Zero Emission Vehicles and Fuels

Projects that help transition to clean options by deploying zero emission vehicles, fuels, and facilities. Examples include:

- Installing electric vehicle charging stations
- Sustainable aviation fuels
- Eliminate leakages and enable use of pipelines for clean sustainable fuels
- Clean hydrogen freight trucks
- Accommodating solar arrays or transmission lines in the right-of-way to allow for more renewable energy.
- Transition public fleets to low / no emission



# Strategies to Reduce Transportation Emissions

## Lifecycle Emissions

### Reduce infrastructure emissions (embodied carbon)

- Use materials that are produced with lower carbon emissions. See FHWA Sustainable Pavements program. Environmental product declarations (EPDs) document environmental impacts and can help transportation agencies make procurement decisions.
- Reduce emissions from heavy construction equipment by using zero-emission or efficient equipment.
- Focus on maintaining existing infrastructure rather than building new.
- Use recycled or reused materials.



Warm mix asphalt uses less energy. Credit: PennDOT

### Reduce fuel cycle emissions (from extraction, processing and transport of fuels)

- Sustainable biofuels (for example from food waste or corn stover) for heavy duty vehicle, marine, and aviation applications. Electrification.

### Reduce vehicle cycle emissions (from manufacturing, maintaining, and disposing of vehicles)

- EPDs, company Environmental, Social, and Governance (ESG) policies, recycling.



Corn stover (stalks, leaves and cobs that remain after harvest) can be used to make sustainable biofuels. 7

# Adaptation: Strategies to Improve Climate Resilience

Maintain and Manage	Strengthen and Protect	Enhance Redundancy	Avoid or Relocate
<p>Absorb increased maintenance and repair costs, proactive maintenance such as cleaning out drainage before a storm, improve real-time response to severe events, sensors to detect changes and alert to thresholds, slow trains when heat means possibility of rail kink.</p>	<p>Design infrastructure to withstand future climate conditions (larger drainage capacity, stronger structures to withstand high winds and waves, materials suited to higher temperatures). Build protective features such as retaining walls, flood walls, levees, revetments, vegetative buffers.</p>	<p>Build additional evacuation routes.</p> <p>Identify system alternatives such as increased bus service in event of rail interruption.</p>	<p>Site new facilities in less vulnerable locations.</p> <p>Relocate or decommission transportation infrastructure located in extremely vulnerable or indefensible areas.</p>
			

# Strategies to Improve Climate Resilience: Maintain and Manage

- Absorb increased maintenance and repair costs
- Proactive maintenance, such as cleaning out drainage before a storm or installing grating to keep debris out
- Improve real-time response to severe events
- Sensors to detect changes and alert to thresholds
- Slow trains when heat means possibility of rail kink



# Strategies to Improve Climate Resilience

## Strengthen and Protect



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Design infrastructure to withstand future climate conditions:

- Larger culverts, or replace culvert with bridge
- Larger drainage capacity
- Stronger structures to withstand high winds and waves
- Raise structures above flood levels
- Materials suited to higher temperatures
- Protective features such as retaining walls, flood walls, levees, revetments, vegetative buffers



# Strategies to Improve Climate Resilience

## Enhance Redundancy

- Build alternative routes or additional evacuation routes
- Identify system alternatives such as increased bus service in event of rail interruption



# Strategies to Improve Climate Resilience

## Avoid or Relocate

- Site new facilities in less vulnerable locations
- Relocate or decommission transportation infrastructure located in extremely vulnerable or indefensible areas





# Nature-based Solutions

- Use natural materials and processes to reduce flood risks, erosion, wave damage, heat impacts, and other risks.
  - Conservation, restoration, or construction of:
    - Marshes
    - Breakwaters
    - Dunes
    - Reefs
    - Beaches
    - Forests
    - Floodplains
  - Rain gardens and bioswales
  - Permeable pavements
  - Green roofs
  - Native shoreline vegetation
  - Engineered log jam
- Can combine “green” and “grey” approaches
- Numerous co-benefits: habitat, pollutant filtering, recreation
- Both mitigation and adaptation benefits



# Co-benefits

Climate mitigation and adaptation tend to have a lot of co-benefits. For example . . .

Action to respond to climate change	Co-benefit
Switching to electric vehicles	Reduces local air pollutants that cause asthma and other health problems
Providing public transit and intercity rail options	Increases convenience, decreases expenditure on private vehicles, improves equity
Investments in walking and biking infrastructure	Improves safety
Reducing use of petroleum	Improves energy security, limits impacts of price volatility
Building roads to withstand projected flooding	Saves money from repeated repairs



# USDOT Action to Respond to Climate Change

- USDOT is committed to doing its part to tackle the climate crisis.
- We are taking action through our:
  - funding programs,
  - technical assistance,
  - research, and
  - policy leadership.



# Funding Programs

## Formula Programs

- The Department's formula programs have broad eligibilities and can be used to fund a wide variety of transportation projects, including projects that improve resilience and reduce greenhouse gas emissions.

## Discretionary Grants

- The Department's discretionary grants, like RAISE, INFRA, Reconnecting Communities and Neighborhoods, and MEGA include merit criteria on climate change.
- The Maritime Administration's Port Infrastructure Development Program is funding projects to improve resilience to sea level rise, flooding, and extreme weather. It is also funding electric port equipment to reduce emissions.

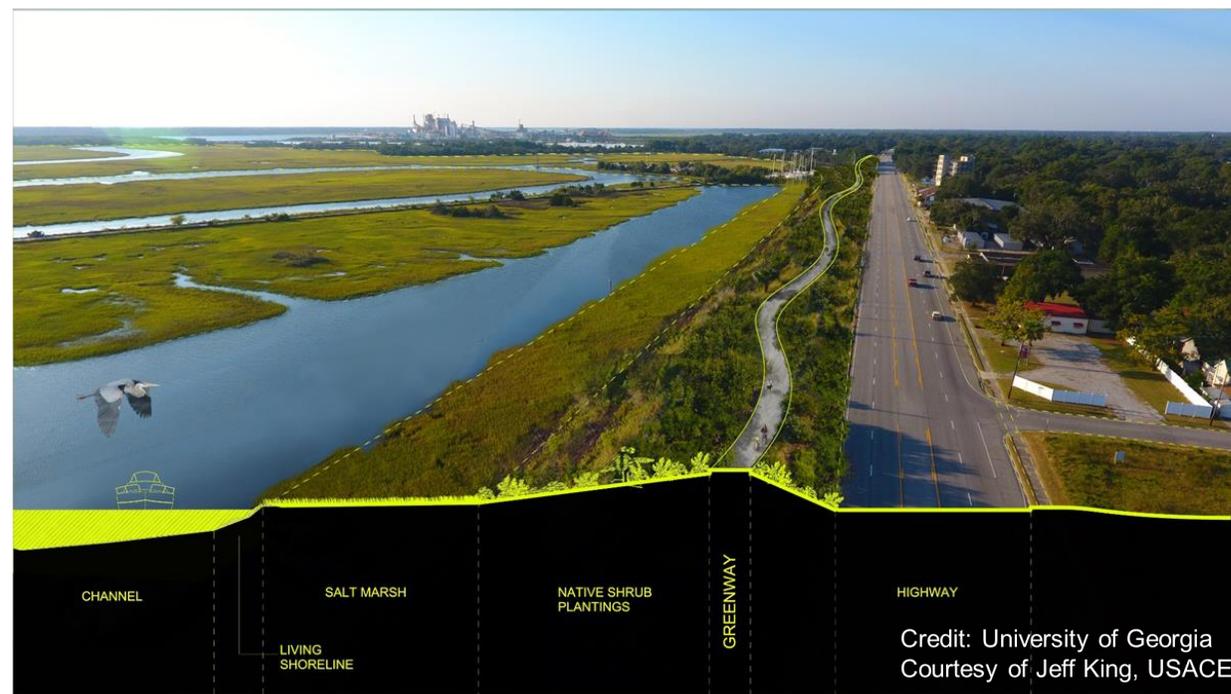


# Funding Programs with a Focus on Climate Change

## Multimodal, administered by Federal Highway Administration

- **Carbon Reduction Program** - provides \$6.4 billion over 2022 to 2026 in formula funding for the development of State carbon reduction strategies and projects that reduce transportation emissions, including traffic management, public transportation, pedestrian facilities, alternative fuels, and port electrification.
- **Promoting Resilient Operations for Transformative, Efficient, and Cost-saving Transportation (PROTECT)** - provides \$9.1 billion in funding between 2022 and 2026 for improving the resilience of highway, transit, intercity rail, and port facilities to current and future weather events, natural disasters, and changing conditions.

Credit: [www.pedbikeimages.org](http://www.pedbikeimages.org)  
/ Nathan Roseberry (CDOT)



Credit: University of Georgia  
Courtesy of Jeff King, USACE

# Funding Programs with a Focus on Climate Change

## Air

- **Fueling Aviation's Sustainable Transition (FAST) Grant Program** – funds Sustainable Aviation Fuels (SAF) and low-emission aviation technologies
- **Voluntary Airport Low Emissions Program**
- **Zero Emissions Vehicle Program**
- **Airport Zero Emissions Vehicle and Infrastructure Pilot Program**

## Rail

- **Consolidated Rail Infrastructure and Safety Improvements (CRISI) Provision 16** – funding to replace inefficient locomotives with cleaner alternatives.
- **Federal-State Partnership for Intercity Passenger Rail Grant Program** expands and improves the Nation's intercity passenger rail system to increase access to more efficient intercity transportation options.

## Ports

- **Reduction of Truck Emissions at Port Facilities Program** - provides \$400 million in competitive funding to reduce truck idling and emissions at ports, including through the advancement of port electrification.

# Funding Programs with a Focus on Climate Change

## Highway

- **National Electric Vehicle Infrastructure (NEVI) Formula Program** - provides \$5 billion to deploy electric vehicle charging infrastructure
- **Charging and Fueling Infrastructure Discretionary Grant Program** - provides \$2.5 billion to deploy electric vehicle charging infrastructure and hydrogen, propane, and natural gas fueling infrastructure in communities, along designated Alternative Fuel Corridors and in other publicly accessible locations.
- **Low Carbon Transportation Materials Grants**



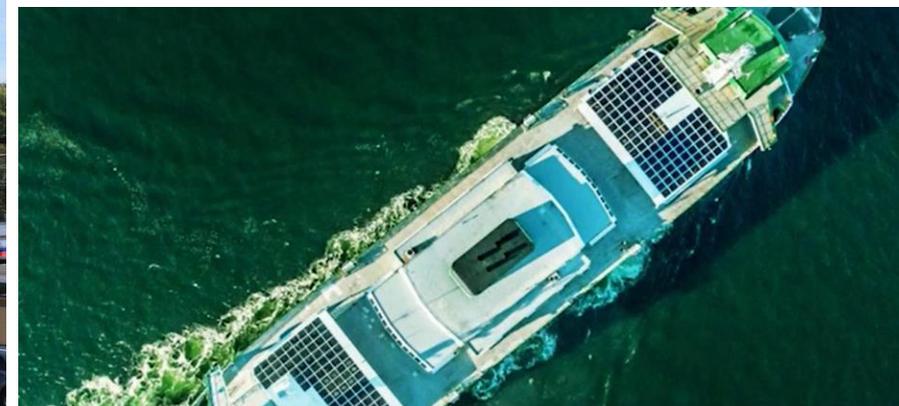
# Funding Programs with a Focus on Climate Change

## Public Transportation

- **Low or No Emission Vehicle Program** - helps public transit agencies buy zero emission and low emission transit buses.
- **Transit Oriented Development Pilot Program** - provides funding to local communities to integrate land use and transportation planning with major public transportation investments. Aligning transportation and land use allows people to get to jobs, housing, shopping, and more with lower emissions and greater convenience.
- **Electric or Low-Emitting Ferry Pilot Program** - provides competitive funding for projects that support the purchase of electric or low-emitting ferries and the electrification of or other reduction of emissions from existing ferries.



Mass Transit District, Urbana, IL



Washington State Ferries, Olympia, WA



# Complementary Funding Programs

## Inflation Reduction Act (2022)

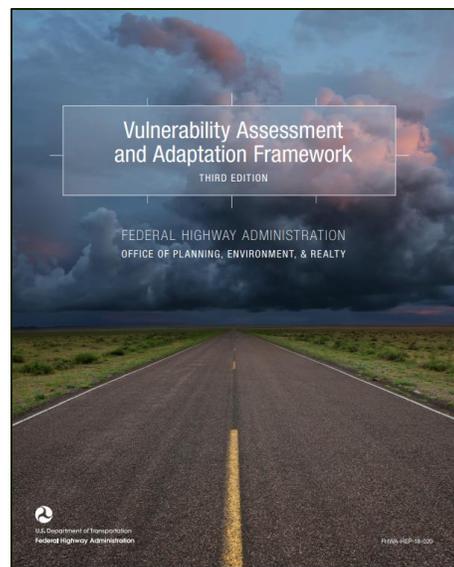
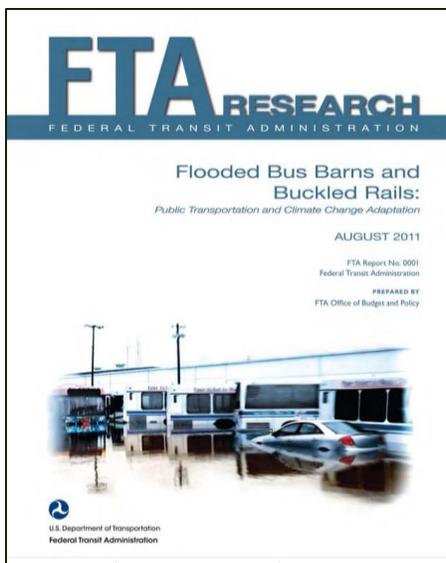
- \$3 billion for electrifying the US Postal Service fleet
- \$1 billion in grants for state and local governments to purchase electric heavy-duty vehicles.
- Tax credits for the purchase electric vehicles (\$7,500 per new vehicle, \$4,000 or 30% of purchase price for used vehicles)





# Technical Assistance

- Joint Office of Energy and Transportation
- Thriving Communities Program
- Rural Opportunities to Use Transportation for Economic Success (ROUTES)
- FHWA Every Day Counts Initiative: Integrating GHG Assessment and Reduction Targets in Transportation Planning
- Numerous USDOT training, technical manuals, case studies, and compilations of best practices



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FHWA Home / OIPD / Accelerating Innovation / Every Day Counts / EDC-7: Integrating GHG Assessment and Reduction Targets in Transportation Planning

CAI Home **Every Day Counts** STIC Network AID Demonstration AMR Program Resources

**Integrating GHG Assessment and Reduction Targets in Transportation Planning**

**By incorporating greenhouse gas (GHG) analysis into transportation planning, agencies can act now to help decrease future emissions.**

Transportation is the largest emitter of greenhouse gases (GHGs) in the United States—as well as one of the fastest-growing sources. [National inventories](#) suggest the transportation sector generates approximately 29 percent of the Nation’s GHG emissions, and roadway vehicles account for about 83 percent of that amount. Integrating the consideration of GHG emissions into transportation planning and decision-making is a critical step that agencies can take toward meeting national reduction goals and reducing their climate impact.

**Tools and Practices for Effective Decision-Making**

State departments of transportation (DOTs) and metropolitan planning organizations (MPOs)

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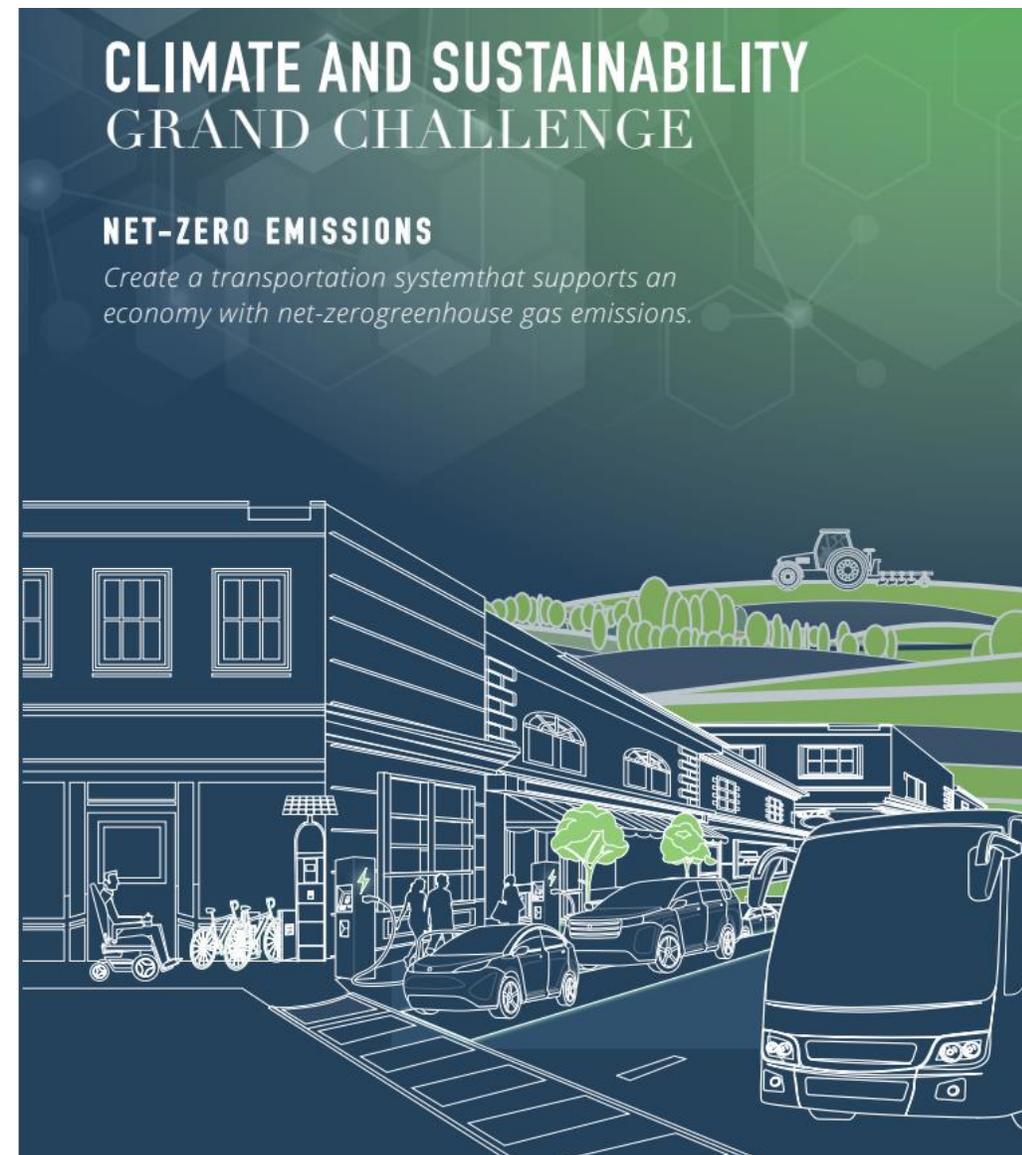
# Research

DOT research programs are developing innovations that will reduce emissions, such as:

- Sustainable aviation fuels,
- Hydrogen and battery electric locomotives,
- Low carbon construction materials, and
- Vehicle battery technology.

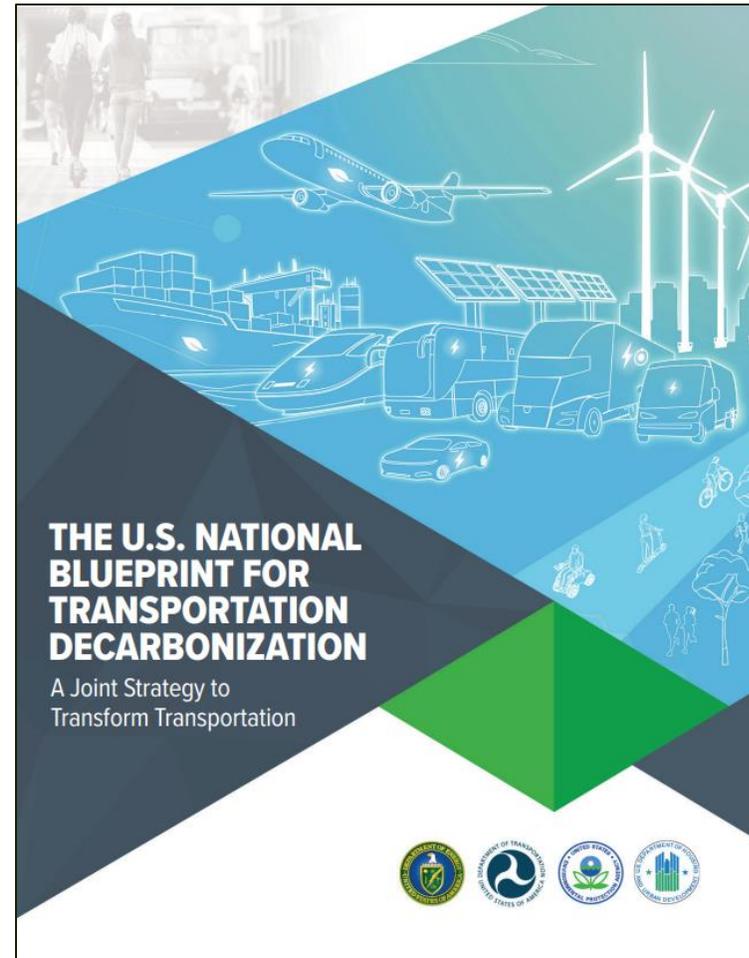
[DOT RD&T Strategic Plan 2022-2026](#) sets USDOT's research agenda for Climate and Sustainability along with four other goals.

University Transportation Centers (UTCs) focused on climate change



# Policy Leadership

- Policy statements on climate change
- US National Blueprint for Transportation Decarbonization
- Fuel economy standards
- Climate Challenges - operating administrations within the department developed Climate Challenges for their modes to encourage transportation stakeholders to take bold action to further reduce greenhouse gas emissions.
- Council on Environmental Quality's guidance on incorporating analysis of both greenhouse gas emissions and climate resilience into the NEPA process.
- Leading by example - making sure USDOT buildings and fleets are as clean and green as possible.



# What you can do

If you are a . . .	
Engineer	Learn about climate informed science techniques and incorporate future climate projections into engineering design.
Planner	Incorporate climate considerations into planning using practices such as scenario planning, vulnerability assessments, and integrated land use and transportation planning.
Environmental Specialist	Make sure you are up to date on the Council on Environmental Quality's 2023 guidance on incorporating climate change considerations in the NEPA process.
Researcher	Analyze climate action strategies and share your findings with decision-makers.





# Takeaways

- There are three main strategies for reducing transportation greenhouse gas emissions:



- We need to incorporate information on current and future climate change impacts when we plan, design, build, operate and maintain our transportation networks in order to reduce damage and disruption.
- USDOT is committed to doing its part to tackle the climate crisis, including through our funding programs, technical assistance, research, and policy leadership.
- You can be part of the solution.



# Resources

**USDOT Climate Change Website:**  
[https://www.transportation.gov/priorities/  
climate-and-sustainability/](https://www.transportation.gov/priorities/climate-and-sustainability/)

DOT Climate Change Center  
Joint Office of Energy and Transportation

## National Highway Institute Climate Resilience Courses

- [142081 Understanding Past, Current and Future Climate Conditions](#)
- [142082 Introduction to Temperature and Precipitation Projections](#)
- [142083 Systems Level Vulnerability Assessments](#)
- [142084 Adaptation Analysis for Project Decision Making](#)
- [142085 Addressing Climate Resilience in Highway Project Development and Preliminary Design](#)

