Climate Change Mitigation Study of 2021 – Literature Review

TPB Technical Committee

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ICF

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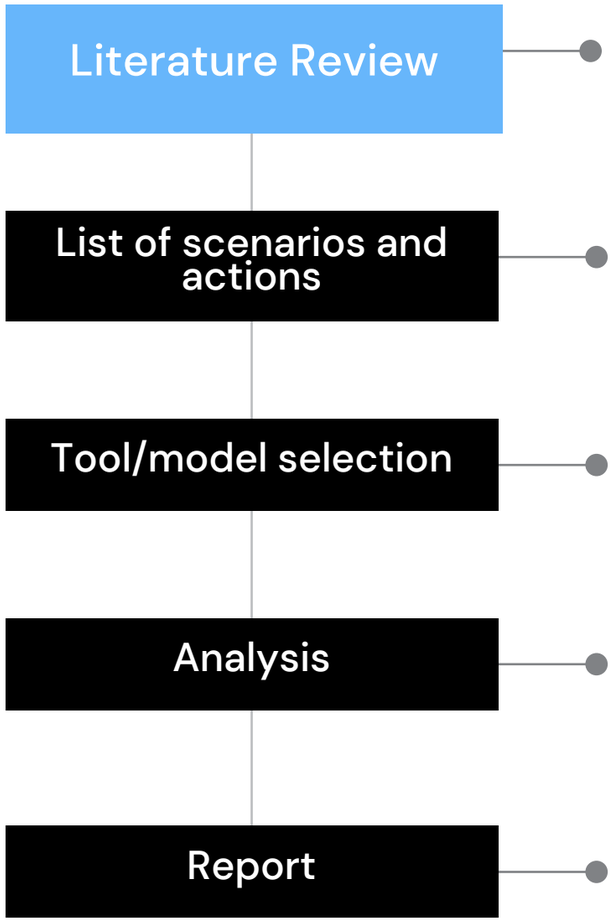
Agenda Item #7

Key Analysis Steps



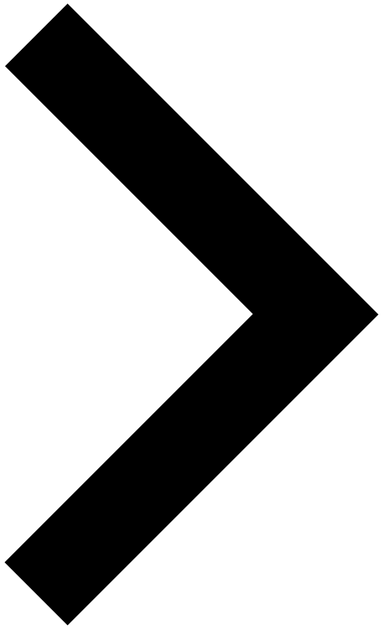
Conduct literature review of climate change mitigation studies conducted in other regions and states

Develop a limited list of scenarios and associated GHG reduction actions to explore

Select tools/models for the analysis

Calibrate and validate the selected tools and models; conduct analysis using the selected tools

Document and present findings in a draft and final report



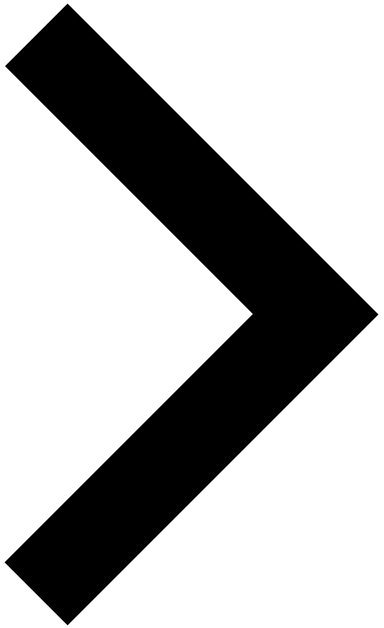
Purpose of Literature Review

Key Questions

What are regional agencies and utilities doing to reduce transportation sector GHG emissions?

How have other cities and states across the world achieved GHG reductions? Or plan to achieve GHG reductions?

What is known about transportation strategies and their effectiveness at reducing GHG emissions?



What are regional agencies and utilities doing to reduce transportation sector GHG emissions?

State Government Targets and Strategies

Jurisdiction	GHG Reduction Target	Transportation Target	Vehicle/Fuel Strategies	Vehicle Travel Demand	Mmgt. and Operations Strategies	Carbon Pricing/ Fuel Pricing
Maryland	Maryland law requires a minimum of 40% by 2030, but the GGRA Plan committed to the more ambitious goal of 50% by 2030 and net zero by 2045, from 2005 levels	40% GHG reduction by 2030 from 2005 levels, and strive to have 535,000 PHEVs and BEVs registered in MD (without Federal action) or 790,000 vehicles (with Federal action) by 2030	✓	✓	✓	
Virginia	30% below the business-as-usual projections by 2025 Carbon free by 2050	No transportation-specific GHG emission reductions target.	✓	✓	✓	
Washington, DC	50% below 2006 levels by 2032, and of 80% by 2050	Goal for all new vehicles registered in DC to be electric by 2050	✓	✓	✓	✓

Local Government Targets and Strategies

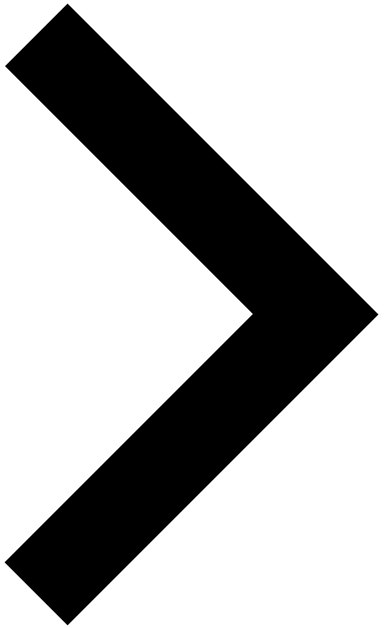
Jurisdiction	2050 GHG Reduction Target	Transportation Goals	Vehicle/ Fuel Strategies	Vehicle Travel Demand	Mmgt. and Operations Strategies	Carbon Pricing/ Fuel Pricing
Alexandria, VA	80-100% Reduction (from 2005 level)	• By 2023 reduce VMT per capita 1% per year • By 2023 increase transit, walking, and biking by 15% over 2018 • By 2030, double dedicated bus lanes to 1.5 miles	✓	✓		
Arlington County, VA	Carbon Neutral	Reduce the amount of carbon produced from transportation to 0.5 MTCO2e/capita/year by 2050.	✓	✓		
Fairfax County, VA	Carbon Neutral	In Development	✓	✓	✓	
Montgomery County, MD	Carbon Neutral by 2035	• 100% electrification of transportation options by 2035. • Reduce private vehicle trips from 75% of total trips to 60% by 2027. • Double the proportion of bus, rail, and bicycle trips (from 2018 level) by 2035.	✓	✓	✓	✓ Advocate for carbon tax / gas tax (notes outside county authority)

Utilities Targets and Strategies

Utility	GHG Reduction Target	Transportation Actions
Dominion	100% of electricity from zero carbon sources by 2045 (Virginia) Methane emissions reductions of 65% by 2030 and 80% by 2050	• Electric school bus program • Autonomous electric shuttle in Fairfax County • EV education • Alternative fuel vehicles – focus on hydrogen and renewable natural gas
WGL	Carbon neutrality from emissions associated with the use of natural gas by 2050	• Introducing cleaner gases to the natural gas mix • Power-to-gas storage for excessive power generated from renewables

PEPCO	100% of electricity to be generated from renewable sources by 2032 (DC)
	
	50% renewable portfolio by 2030 (Maryland)
		• EV incentives
		  • Company fleet electrification
		  • Residential incentive program
		  • Commercial incentive program (Maryland)
		  • Residential time of use rates (DC)
		  • Public charging network
		  • Charging infrastructure for electric buses, taxis, and ride-share vehicles (DC)

BG&E	50% renewable portfolio by 2030 (Maryland)	• Focused on building alternative fuel and energy-efficient hybrid vehicle fleet • Similar goals as PEPCO (both owned by Exelon)



How have other cities and states across the world achieved GHG reductions? Or plan to achieve GHG reductions?

Local and Regional Strategies Across the U.S.

New York City

- Carbon neutral City fleet by 2040
- Bus lane expansion and enforcement
- Reducing truck traffic associated with commercial waste collection

Los Angeles County

- Battery-powered buses and vanpools
- Increased active transportation mode share
- Storing energy captured from trains

City of Boston

- Encouraging mode shifts
- Expanding car sharing
- Improving parcel delivery service sustainability

Puget Sound Region

- Land use policies
- User fees
- Ferry electrification
- Sustainable aviation fuels

San Francisco Bay Area

- Focused growth
- Transportation alternatives campaigns
- Development trip caps

International Strategies

Paris: Low Emissions Zones

- Higher-polluting vehicles have limited access to central Paris. 2024 Zero Diesel and 2030 Zero Petrol targets.

London: Congestion Charge Zone

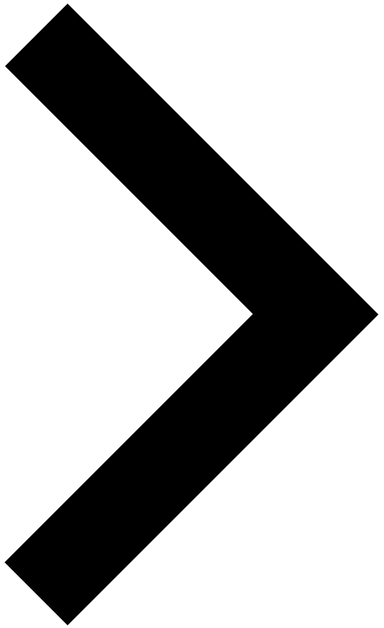
- The number of cars entering the zone fell by 39% between 2002 and 2014.

Norway: Electrification

- Significant incentives for EV purchases; more than half of all new cars sold in 2020 were electric.

Netherlands: Active transportation

- In 2019, 28% of all trips were made by bicycle and 16% by walking



What is known about transportation strategies and their effectiveness at reducing GHG emissions?

Which Federal policies make a difference?

- Fuel Efficiency Standards
- Alternative Fuel Vehicle Incentives
- Renewable Fuel Standards

- Biden Administration policies (including proposed actions)
  - American Rescue Plan (March 2021) – public transportation
  - Proposed Infrastructure Bill
  - Potential carbon pricing policy

Review of Transportation Strategies

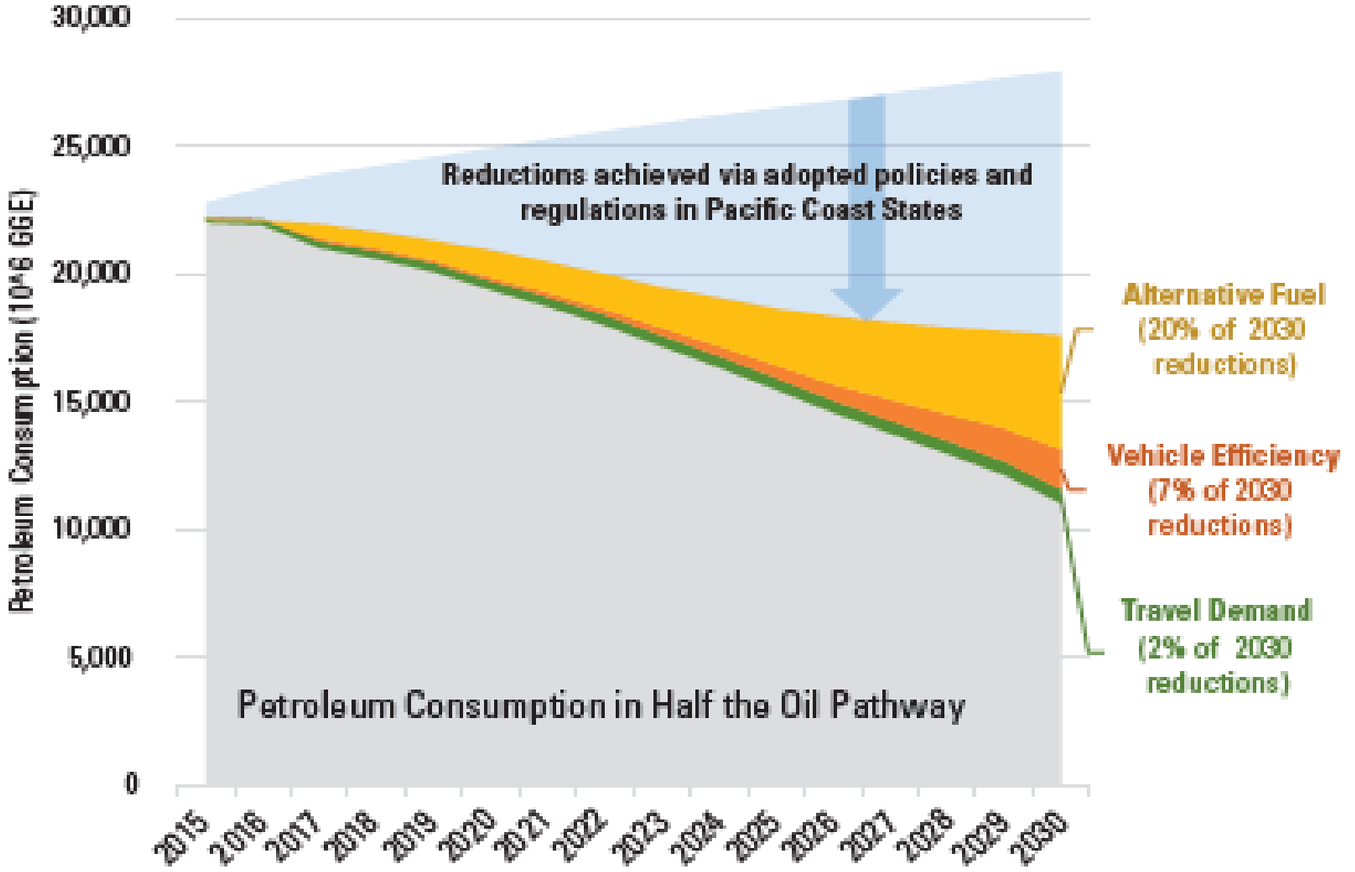
Challenges in comparing studies:

- Strategies can vary in their degree of stringency/application.
- The effectiveness of strategies varies over time.
- Strategy effectiveness depends on context.

Range of implementation methods:

Review of Transportation Strategies

- **Studies addressing a range of transportation strategies generally suggest:**
  - Vehicle technology and fuel strategies have the largest potential for GHG reduction.
  - Mode shift and travel behavior (MSTB) strategies have smaller but notable effects.
  - Transportation systems management and operations (TSMO) strategies are not as often explored.



Source: ICF, "Half the Oil: Pathways to Reduce Petroleum Use on the West Coast," January 2016.

Vehicle / Fuel Strategies

- Hybrid, plug-in hybrid, and electric vehicles
  - **Potential for significant GHG reductions**
    - Estimated 73-76% GHG reduction per vehicle in COG region by shifting to battery electric vehicle, accounting for fuel-cycle emissions.
    - Decarbonization of electric grid increases benefits further.
    - A national study estimated 15% GHG reduction from baseline forecast in 2030 and 94% reduction in 2050 with shifts to EV sales and cleaner grid.
  - **Constraints**
    - Speed of vehicle turnover.
    - Potential for some mileage "rebound effect".
  - **Policies**
    - Incentives / rebates ("cash for clunkers").
    - Considerations related to equity.

- Low carbon fuel standards
  - **Requires fuel producers and suppliers to lower the carbon intensity of transportation fuels.**
  - **Estimated 3.6-5.5% reduction in transportation GHG emissions per year in California, Oregon, and British Columbia.**

Mode Shift and Travel Behavior / VMT Reduction

- For individual travelers and trips, substantial GHG reductions can be achieved by shifting from driving alone to ridesharing, transit, bicycling, walking, or telework.

- At regional scale, studies suggest meaningful but not deep GHG reductions (4-24% reduction compared to baseline forecast in 2050 under aggressive assumptions); effectiveness is boosted with significant road pricing.

- California MPOs generally have 13-19% VMT per capita reduction targets by 2035 (relative to 2005), viewed as challenging targets. Population growth exceeds these levels in many regions, equating to flat or moderately increasing regional VMT.

Mode Shift and Travel Behavior/VMT Reduction

- **Combining some strategies can generate synergistic effects, but some combinations have diminishing returns.**
- **Studies generally show largest effects from:**
  - Pricing strategies such as VMT fees or pay-as-you-drive insurance (which apply to all vehicle travel): 3-10% reduction in light-duty VMT compared to baseline forecast from $0.05-$0.10 per mile fee
  - Land use (smart growth) strategies: Regional impact depends on amount of development growth.
- **Generally smaller effects from transit, bicycle/pedestrian, and micromobility investments**
  - Typically, 1-3% reductions regionally compared to baseline forecast.
  - Constraints: types of trips (generally short for bicycle/ped, although can support first-mile last-mile connections), do not always substitute for vehicle trips.
- **Land use, transit, and active transportation choices have many co-benefits for accessibility, mobility, and equity; road pricing and telework strategies raise some equity concerns.**

Transportation Systems Management and Operations Strategies

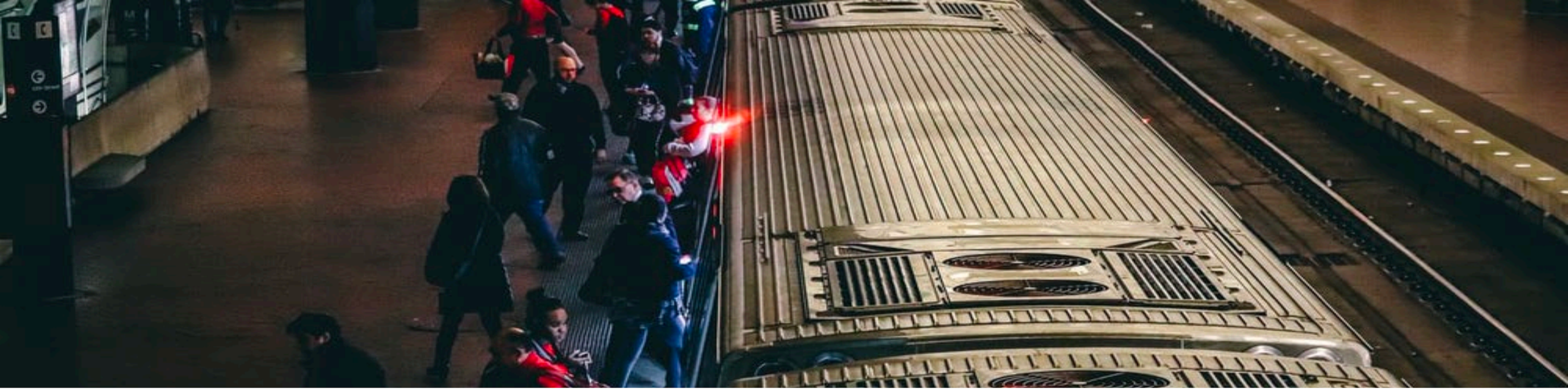
- At the regional level, potential for modest GHG reduction due to smoother traffic flow and less idling.
- On individual roads or corridors, studies generally show 1 to 10% GHG emissions reduction from strategies such as ramp metering, incident management, and signal coordination.
- Eco-driving strategies generally show 2-7% GHG emissions reductions for individual drivers.
- Constraints:
  - Benefits decline as fleet transitions to hybrids/EVs.
  - Potential for induced vehicle travel from improved traffic flow.
- Co-benefits for mobility, accessibility, and fuel savings.

One regional simulation study estimated a combination of operational improvement strategies would:

- *Reduce vehicle hours of travel by 8.8%*
- *Increase VMT by 2.3%*
- *Reduce GHGs by 1.6%*

Carbon Taxes/Fuel Pricing

- Create economic incentives both on travel behavior and vehicle fleet/fuel decisions
- Yields notable short and long-term effects, depending on level of tax.
- Estimated transportation GHG reductions of about 2% to 19% in British Columbia, Ireland, and Sweden.
- Some equity concerns; can be addressed with subsidies and use of revenues for transit, active transportation infrastructure, or other services.



→ Implications / Next Steps

- Regional partners are committed to significant GHG reductions.
- Deep reductions in transportation are challenging without aggressive actions.
- No single strategy will achieve the regional goals; combination of many strategies is required.
- Vehicle fleet/fuel strategies seem to have the largest potential for deep GHG reductions but require significant fleet turnover; mode shift strategies support reductions and provide many co-benefits.
- Carbon pricing reduces GHGs through both vehicle fleet changes and VMT reduction.
- Literature review provides useful starting point for identifying strategies for scenario analysis.

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