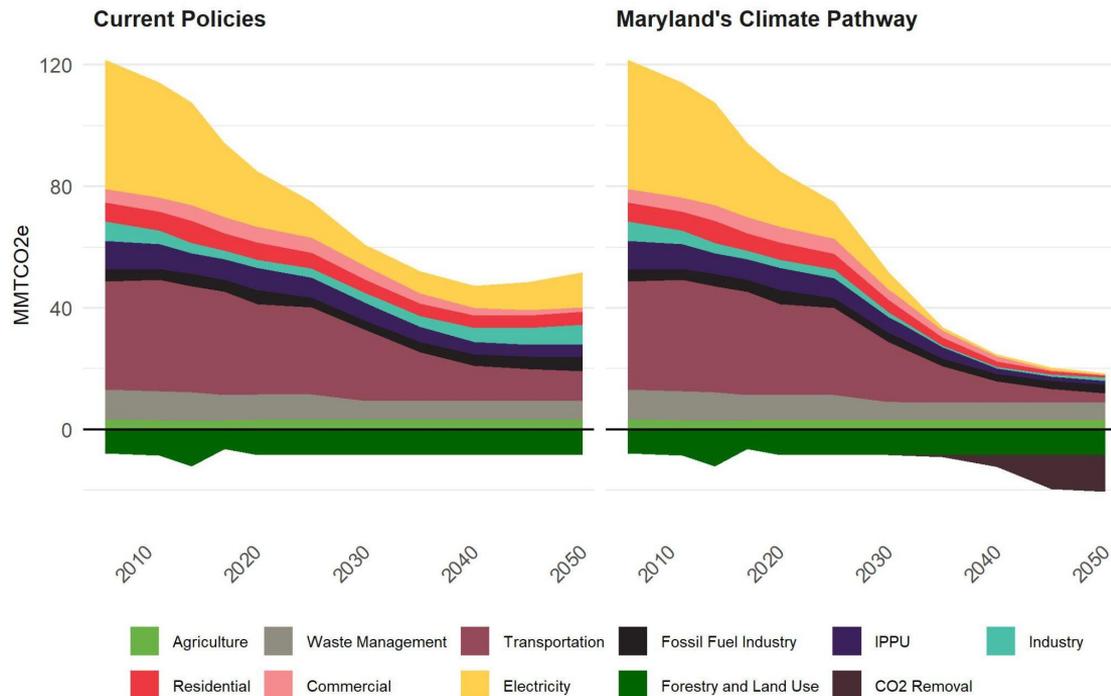# Maryland's Climate Pathway

Mitigation Working Group Meeting
June 15, 2023

Agenda

- Summary of final results for core scenarios
  - Current Policies
  - Maryland's Climate Pathway

- Health benefits from Maryland's Climate Pathway in 2031

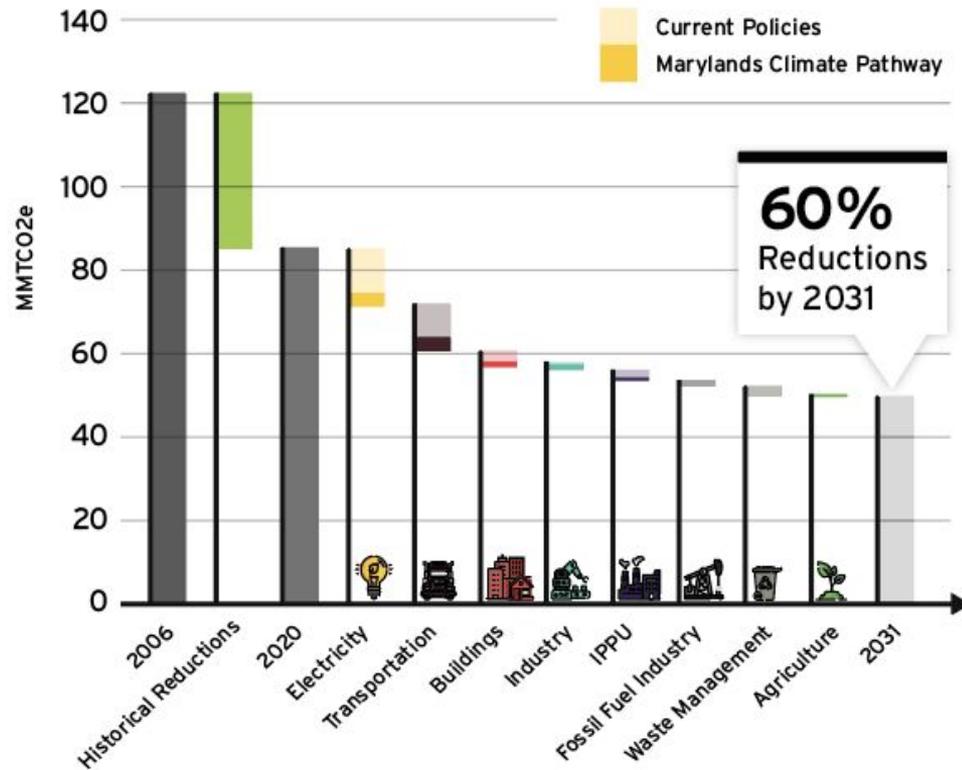- Sensitivity analysis of low state and federal policy implementation

In Maryland's Climate Pathway, economy-wide emissions reduce 60% below 2006 levels by 2031

- Current Policies achieve 51% reductions by 2031, but emissions rebound through 2050 due to expiration of many policies
- Maryland's Climate Pathway reaches 60% gross emissions reduction in 2031 and net-zero in 2045
- Negative emissions are needed to reach net-zero, with ramp-up beginning in 2035

Preliminary results

Current Policies

Maryland's Climate Pathway

MMTCO2e

Legend: Agriculture, Waste Management, Transportation, Fossil Fuel Industry, IPPU, Industry, Residential, Commercial, Electricity, Forestry and Land Use, CO2 Removal

Historical reductions and Current Policies achieve significant reductions, bu more action is needed

- Total reductions needed for 2031 goal: **73.3 MMTCO2e**
- Maryland already achieved **36.7 MMTCO2e** reductions as of 2020
- Full implementation of current policies can achieve another **26.0 MMTCO2e** reductions
- Additional policies must be enacted to close the remaining **10.6 MMTCO2e** gap

Preliminary results

All sectors play a crucial role in reaching 60% reductions, but opportunities vary across sectors

Percent emissions reductions achieved by 2031 in Pathway	
Economy-wide	*60%*
Electricity	89%
Transportation	49%
Buildings	35%
Industrial	79%
IPPU	47%
Fossil Fuel Industry	26%
Waste Management	39%
Agriculture	9%

- Largest reductions come from the electricity sector
- Transportation reductions are large in MMTCO2e, but relatively low as a percent-change compared to some other sectors
- Agriculture contributes relatively little to reductions, but is a smaller sector overall

Preliminary results

Health benefits assessment uses well-known EPA tool - COBRA model

- CO-Benefits Risk Assessment Health Impacts Screening and Mapping Tool (COBRA) was developed by EPA and previously used in 2030 GGRA Plan
- Models the emission and dispersal of particulate matter (PM 2.5), sulfur dioxide (SO_2), nitrogen oxides (NO_X), ammonia (NH_3), and volatile organic compounds (VOCs)
- Translates emissions into health effects at the county level across the contiguous USA
- Compares health outcomes between different scenarios: i.e., what is the benefit of Maryland's Climate Pathway compared to Current Policies?

Statewide summary of health benefits from Maryland's Climate Pathway

- Avoided mortality is largest contributor (>98%) to the estimated total health benefits in monetary terms ($263-$591 million)
- Largest reduction in incidence rate is minor restricted activity days, meaning the benefits are experienced by the largest number of people
- Additional key incidence rate reductions:
    - There would be approximately 2,818 fewer work loss days in 2031
    - The incidents of Asthma Exacerbation will decrease by approximately 587
    - The reduction in incidents of Upper Respiratory Symptoms will be approximately 575

Preliminary results

Maryland's Climate Pathway sees pollutant reductions centered on Baltimore City and Bay area

- PM 2.5 reductions shown in µg/m^3
- Benefits center on population centers where sources of pollution are greatest
- Results are specific to 2031 - not cumulative

Reduction in PM 2.5 concentrations
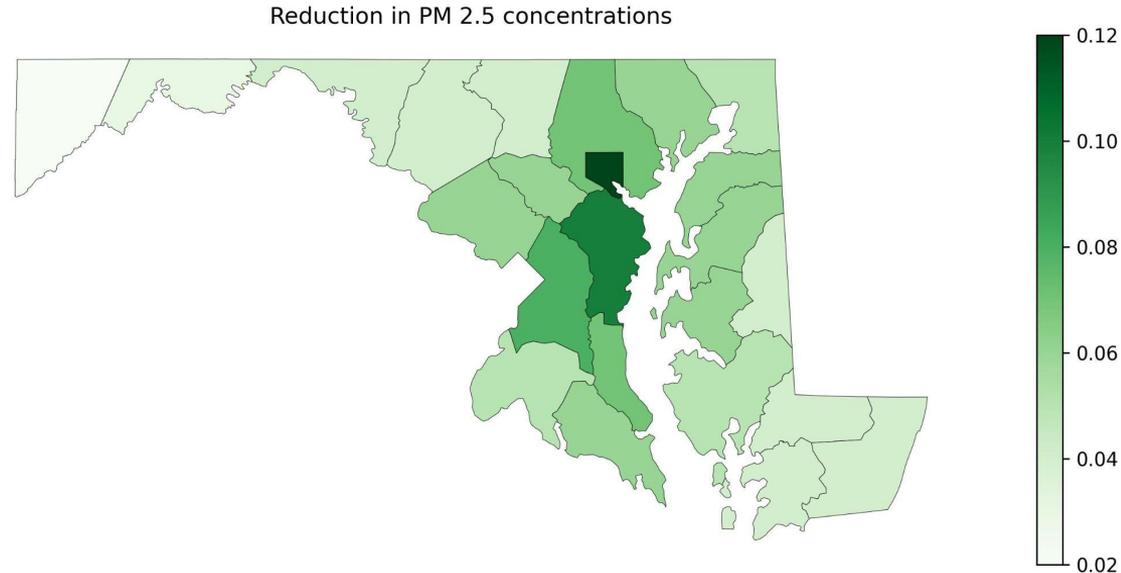
Preliminary results

Total health benefits per person are centered around the Chesapeake Bay

- Total benefits includes monetized value of all avoided symptoms and avoided mortality
- Statewide benefits estimated to be between $263-$591 million in 2031
- Baltimore City, Kent, Anne Arundel, and Talbot counties have the greatest estimated total health benefits from the Pathway scenario, on per capita basis

Total Health Benefits ($ per capita) - High Estimate

Preliminary results
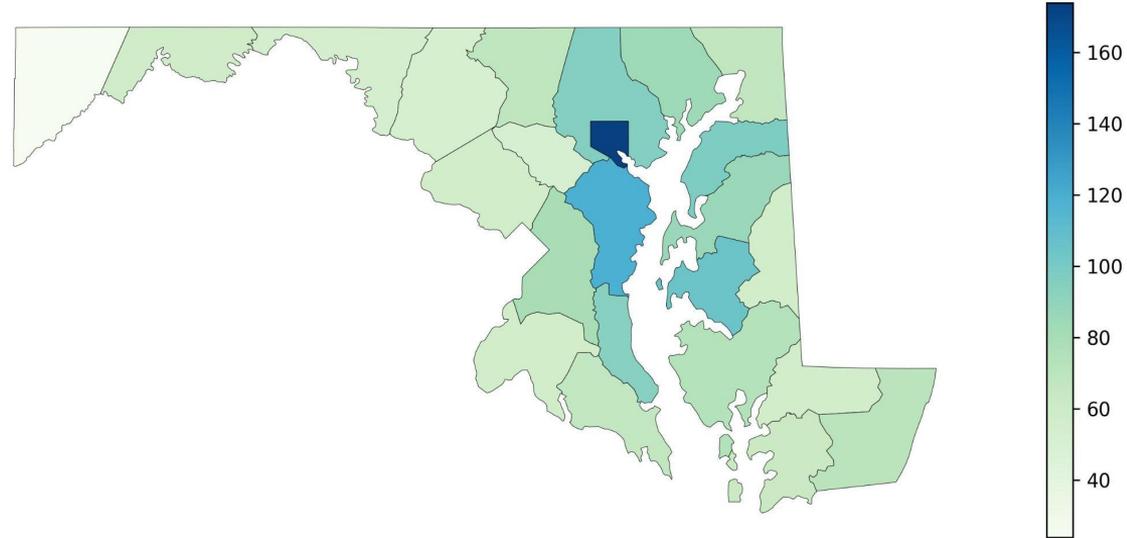
Avoided upper respiratory symptoms primarily benefit major population centers

- Incidence of upper respiratory symptoms are expected to reduce greatly for Baltimore City and the areas south and west of Baltimore

Avoided Upper Respiratory Symptoms per 100,000 population

Preliminary results
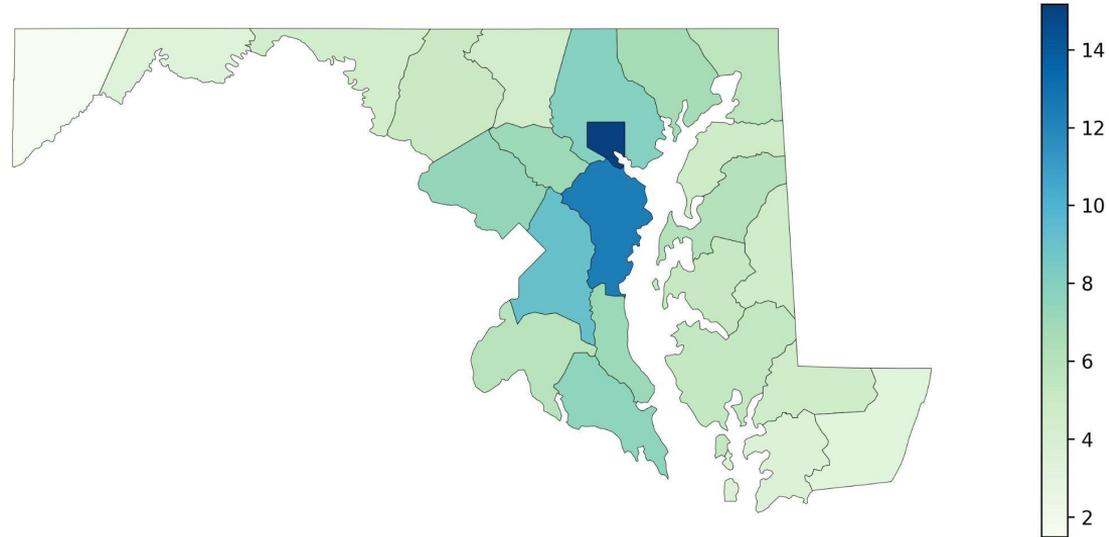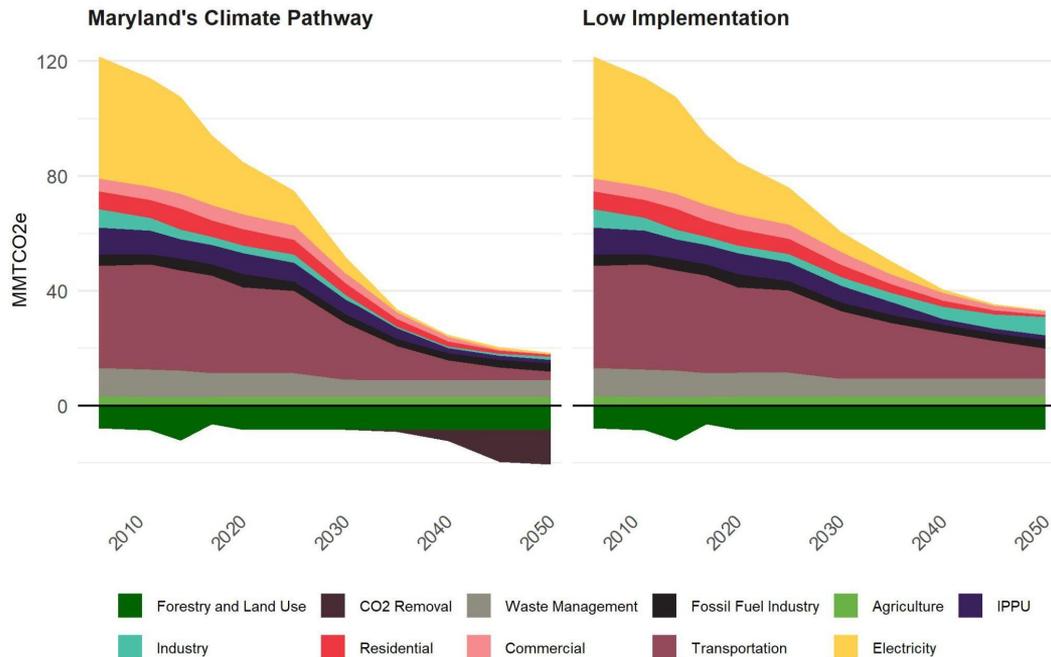
County-Level Result Highlights

- Baltimore City, a well-known focus area for environmental justice issues such as pollution from waste incineration and from Baltimore Harbor, is estimated to have 96 fewer incidents of asthma exacerbation
- Prince George's County, diverse and densely populated, is expected to have 475 fewer work loss days
- Washington, Worcester, Talbot counties will see the greatest reduction in minor restricted activity days per capita
- Garrett County, with the lowest monetized $/person benefit, is still estimated to see significant delivered total health benefits delivered in 2031 though, between $383,821 - $864,379

Preliminary results

Sensitivity scenario models Low Implementation of key policies at the state and federal level

- **Transportation electrification**: delayed achievement of ACC II and ACT, nonroad emissions fail to electrify
- **VMT**: reductions are half of Maryland's Climate Pathway
- **BEPS**: compliance rate half of Maryland's Climate Pathway
- **Zero emissions appliance & construction standards**: compliance delayed
- **Solar and wind deployment**: all MD and RGGI targets delayed
- **Waste**: No additional waste diversion
- **Cap & invest**: policy not included
- **IRA**: effect of PTC, ITC, clean vehicle tax credits cut in half

# Low Implementation scenario misses state target by 10.2 MMTCO2e

- Low implementation of policies leaves a gap of 10.2 MMTCO2e to the state target

- Without cap-and-invest, carbon removals do not deploy and 2045 net emissions are 27.0 MMTCO2e

Maryland's Climate Pathway

Low Implementation

MMTCO2e

Forestry and Land Use   CO2 Removal   Waste Management   Fossil Fuel Industry   Agriculture   IPPU

Industry   Residential   Commercial   Transportation   Electricity

Preliminary results

Low electrification reduces electricity consumption, but significant renewables growth still needed

- Electricity sector under low policy implementation achieves 84% reductions in 2031
  - 89% in Pathway
- Electricity consumption is lower due to less electrification in transport and industry
- Unabated natural gas continues through 2040, but renewables still increase substantially


Preliminary results
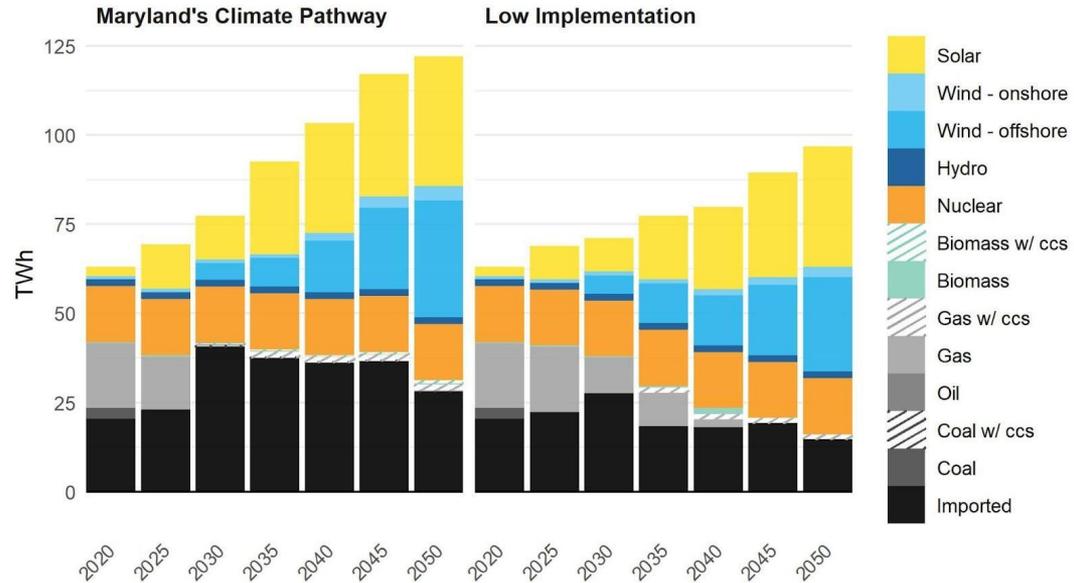
Delayed achievement of ZEV targets significantly changes personal vehicle fleet through 2050

- Transportation sector achieves 36% emissions reduction in 2031 under low policy implementation
  - 49% in Pathway
- Passenger-miles stay roughly constant after 2030 instead of declining
- Lower electrification due to delayed sales targets
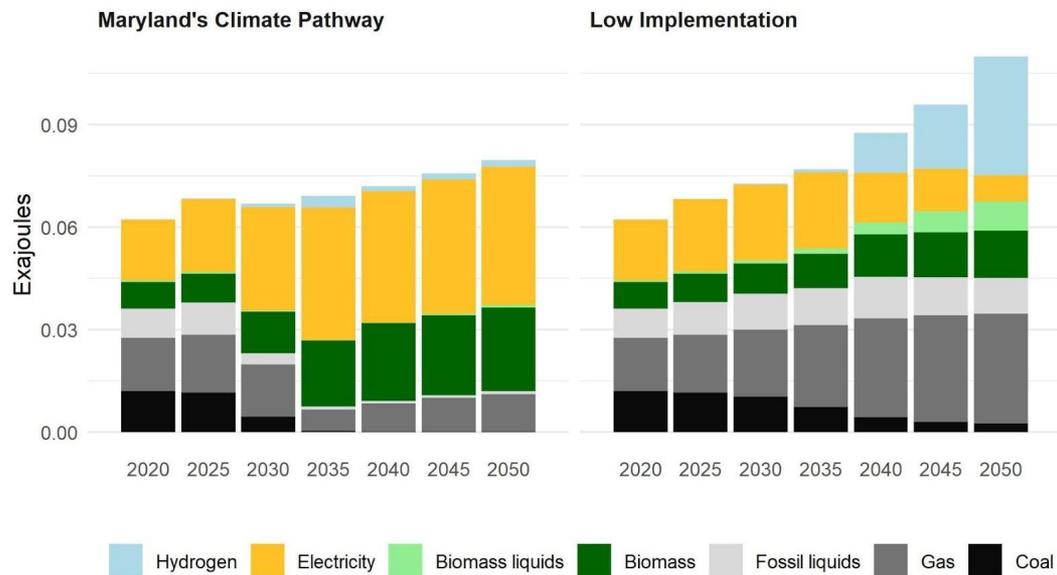

Preliminary results
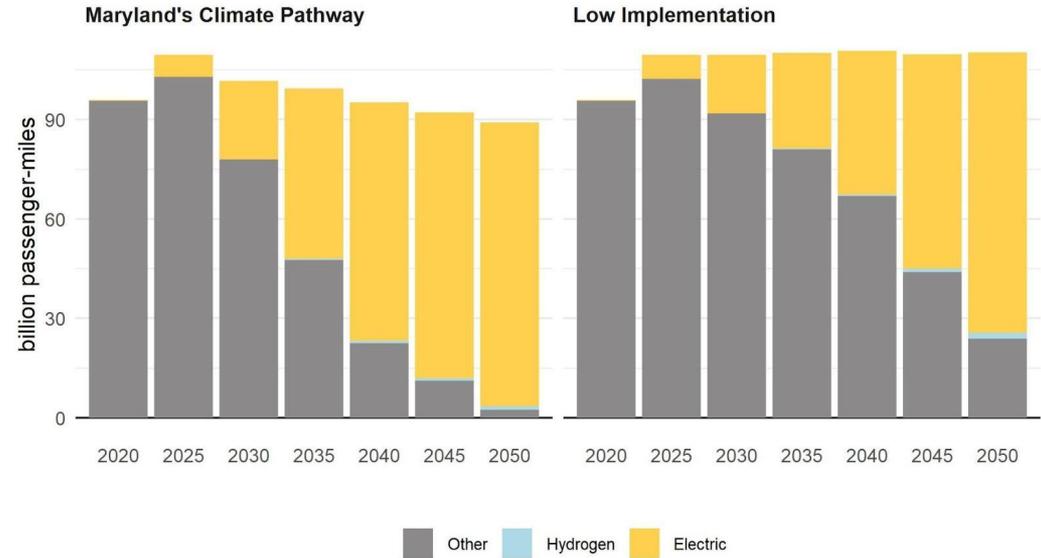
With delayed achievement of sales targets, freight trucks remain primarily ICE vehicles

- Delayed sales targets for freight trucks significantly slow electrification
- Majority of trucking in 2050 still in ICE vehicles under low policy implementation

Preliminary results
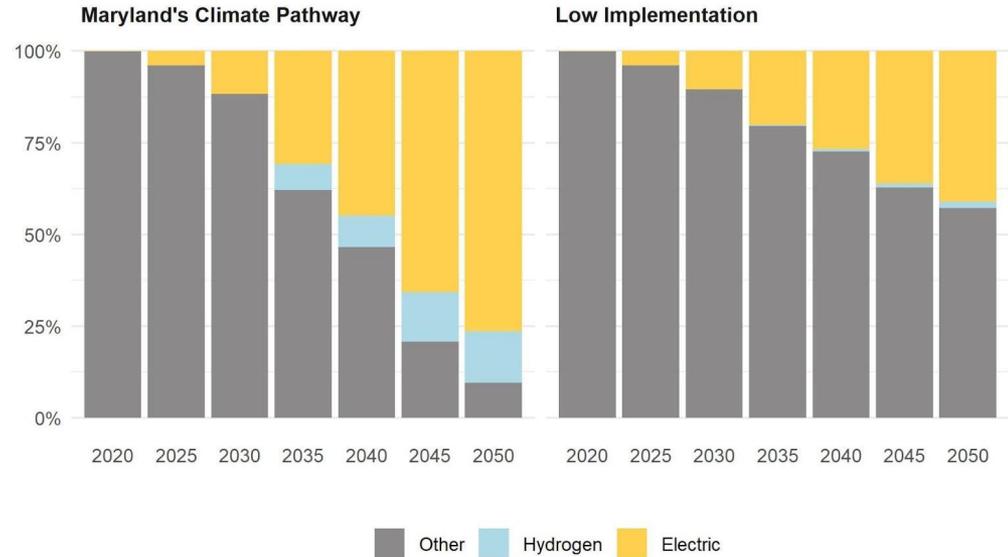
Low implementation of policies reduces industry efficiency and fossil fuel use continues to grow

- Industry achieves 52% emissions reductions in 2031 under low policy implementation
  - 79% in Pathway
- Without cap and invest, sector has limited incentive to move away from fossil fuels
- Policy intervention is essential to achieve reductions in industry

Preliminary results

Summary

- Low implementation of policies risks missing the 2031 and 2045 emission reduction targets
- Largest increases in emissions under low implementation relative to the Pathways scenario occur in the transportation (4.6 MMTCO2e), electricity (1.8 MMTCO2e), and industrial (1.7 MMTCO2e) sectors
- Delays in sales targets for ZEVs mean fleets electrify much slower, resulting in higher use of ICE's through 2050
- Sensitivity highlights the need for policies to target remaining emissions, particularly in the industrial sector, in order to reach state 2031 and 2045 targets
- Net zero in 2045 requires a significant amount of industrial-scale CO_2 removal in order to reach net zero in these scenarios

Preliminary results

Thank you!

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