SCHOOL OF PUBLIC POLICY
CENTER FOR GLOBAL SUSTAINABILITY

Maryland Department of the Environment

Pathways to Maryland's GHG Reduction Goals

Mitigation Working Group Meeting
April 13, 2023

Agenda

- Preliminary modeling results for Current Policies scenario
- Update on CSNA scenarios

Scenario Development

- **Current Policies scenario**
  - On-the-books Maryland policies, most relevant federal policies such as IRA and IIJA, most relevant policies for surrounding states
  - *How much can current policies reduce GHG emissions?*
  - *What is the gap we need to close by 2031 and 2045 to meet Maryland's CSNA emissions targets?*
- **CSNA scenarios**
  - Current Policies + new policies to meet CSNA targets
  - Providing alternative conceptual policy pathways to achieve the emissions reduction targets
  - *What additional policies in different sectors are needed to meet the 2031 and 2045 CSNA emissions targets?*

Modeling Methodology & Assumptions

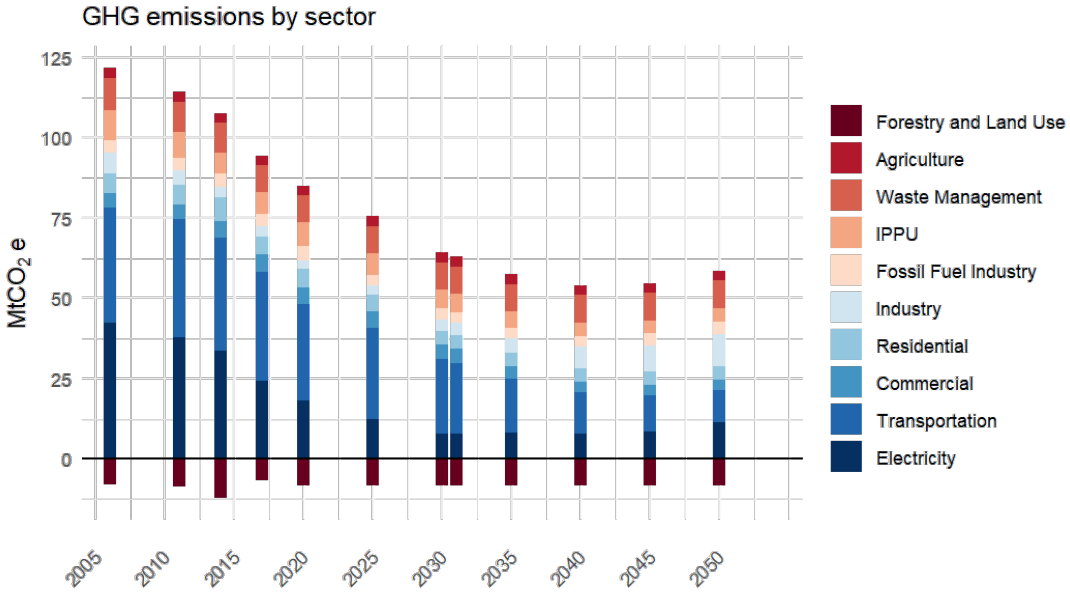
- Using Global Change Analysis Model (GCAM-USA), which as 32 global regions, as well 50 state-level resolution in the USA. The model runs in 5-year time steps.
- CO_2 and energy consumption along with major sources of CH_4, N_2O, and F-gases are modeled at state-level
- Electricity trade in fifteen grid (NERC) regions
- Key inputs, GDP, population and technology assumptions are harmonized with Annual Energy Outlook

Current Policies Scenario

- Key policies included:
  a. **Power:** RPS*, RGGI*, Planned coal retirements, IRA incentives
  b. **Transport:** ACC II, IRA incentives, IIJA infrastructure funding, CAFE standards*
  c. **Buildings/Industry:** EmPower*, Building Energy Performance Standards, IRA incentives
  d. **Non-CO2s:** AIM Act, MD Oil and gas methane regulations, IRA methane fee
  e. **Other:** COVID impacts, GHG constraint on rest of states, Technology cost update
- To be added:
  - MD HFC regulations
  - MD Landfill methane regulations
  - VMT reduction policies
  - Agriculture, forestry and land use

*Note that these policies are implemented as they exist right now, not the new rules/regs being proposed. Anything that is passed into law will be addressed in the final version.

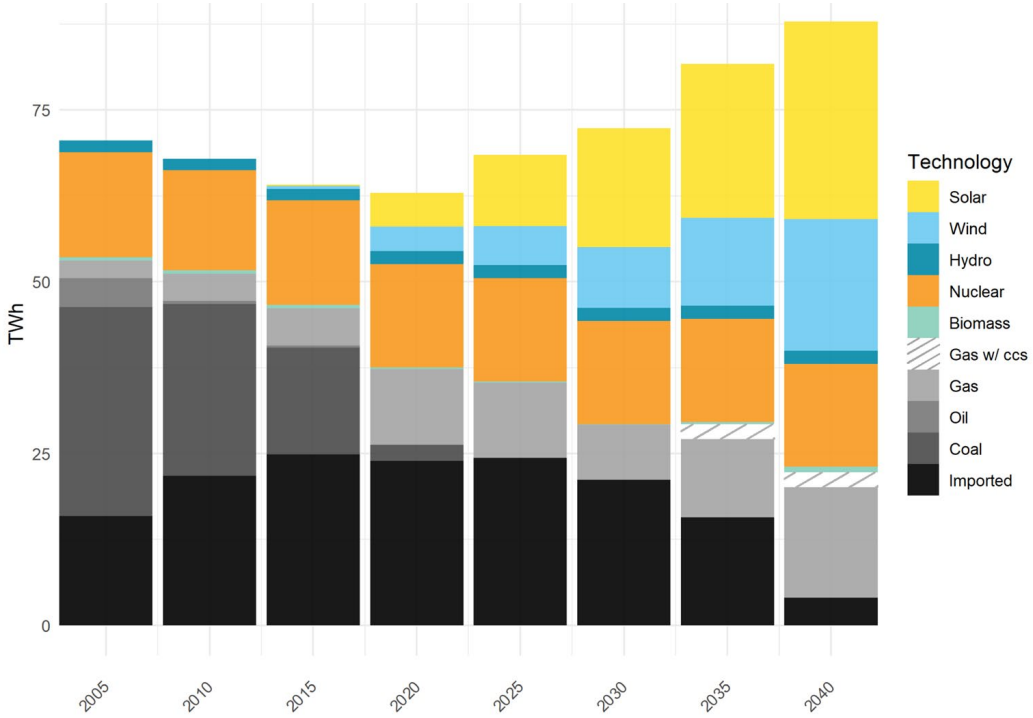
Under Current Policies, economy-wide gross emissions reduce by 48% below 2006 levels by 2031



- 2031 shown as linear interpolation between 2030 and 2035
- Emissions from Waste Management, Agriculture, and Forest and Land Use are held constant at 2020 levels
- Largest emissions reductions occurring the power sector, followed by transportation
- Many policies expire after 2030, so additional action is needed to reach longer term goals

Preliminary results

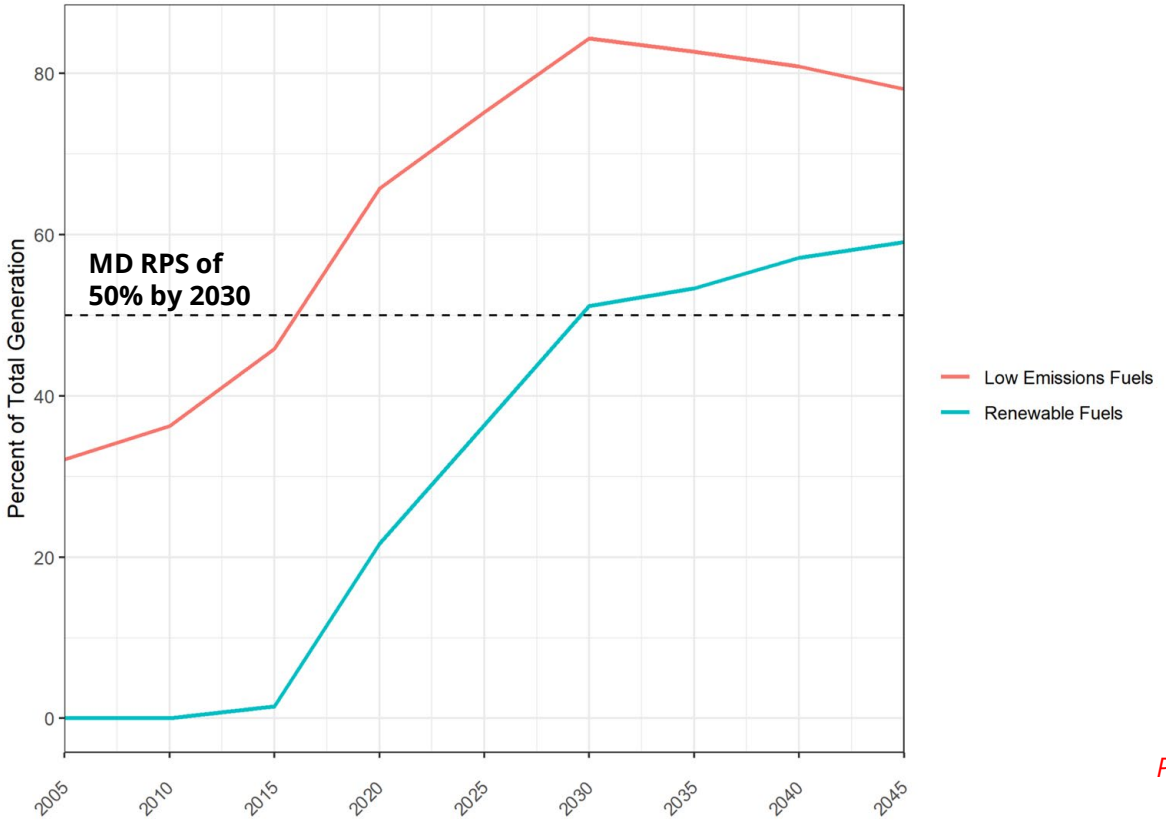
Electricity sector achieves over 80% reductions by 2031, with solar and wind rapidly replacing fossil technologies



- Gas and imports are the primary source of emissions
- Share of electricity from imports declines over time
- Gas generation increases after 2030, as coal is phased out, tax credits expire, & RPS and RGGI are held constant
- **Key policies included:** RPS, RGGI, Planned coal retirements, IRA incentives

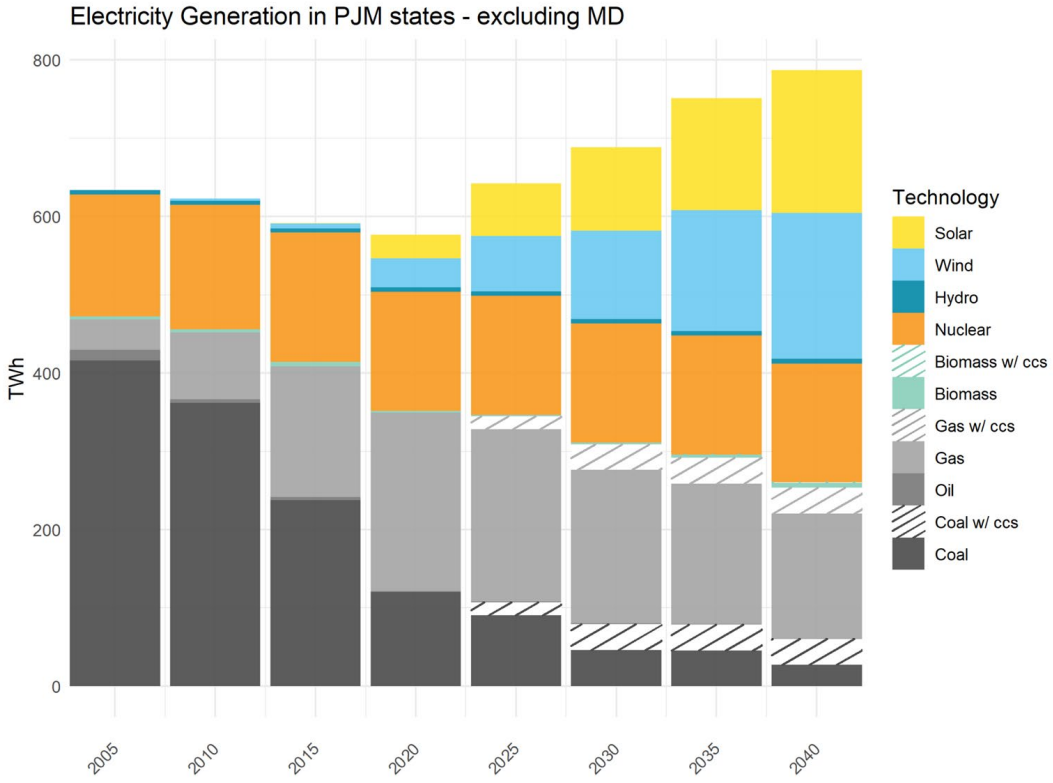
Preliminary results

In-state generation reaches over 50% from renewable sources and over 84% from low emissions sources by 2031



Preliminary results

PJM states also have increasing renewable and low emissions sources in their grids



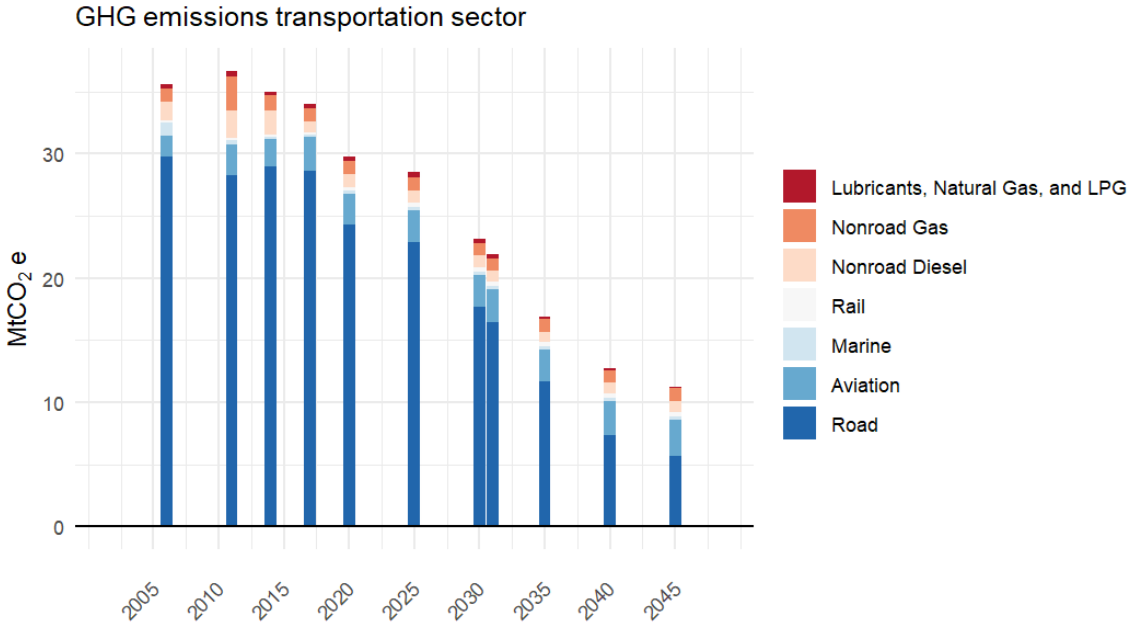
- Not a precise match for imported electricity because PJM boundaries don't align perfectly with state boundaries

Policies in PJM states include:

- IRA incentives
- RPS
- Emissions targets
- Planned coal retirements

Preliminary results

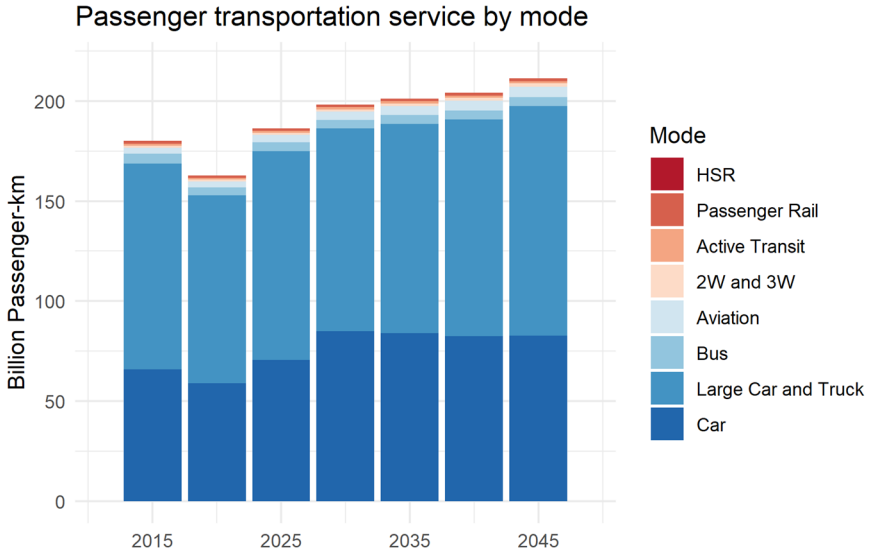
Transportation sector achieves 38% reductions, primarily through road vehicle electrification & efficiency measures

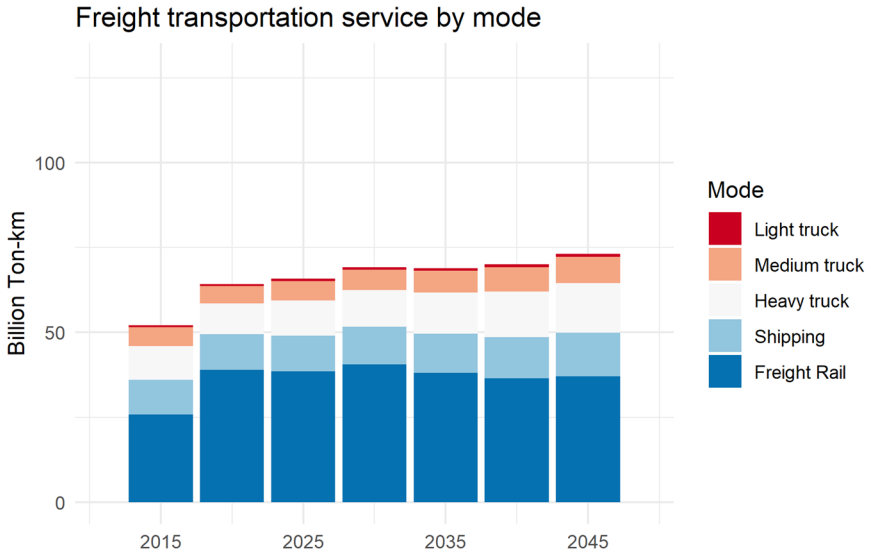


- Emissions matched to inventory sub-categories
- Road vehicles contribute to majority of reductions
- **Key policies included:** ACC II, IRA tax credits, IIJA infrastructure funding, CAFE standards

Preliminary results

Passenger service grows over time; freight service is flatter

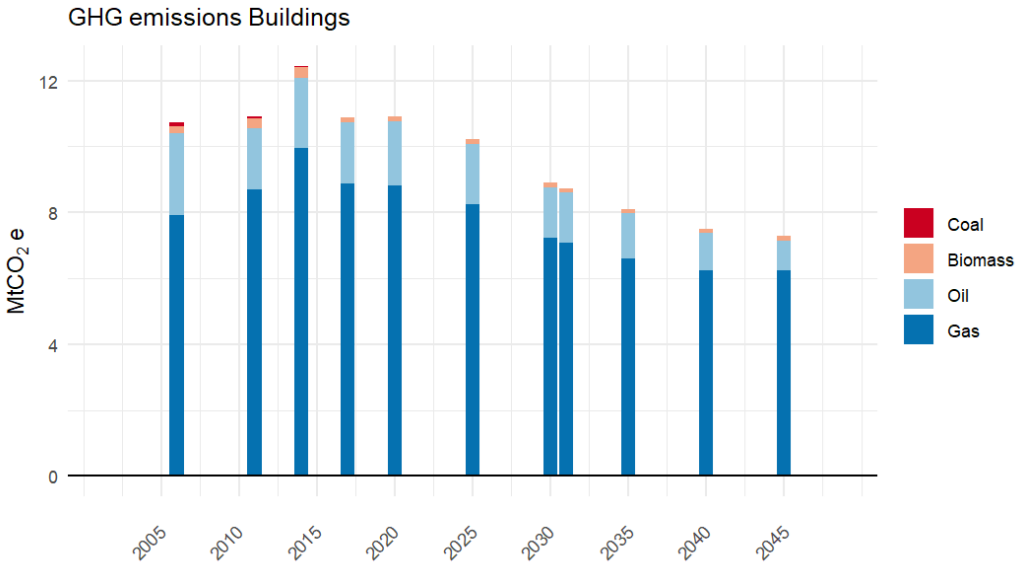




- Passenger service is dominated by cars and SUVs
- Freight service is dominated by rail
- Overall, LDVs dominate road transport service and fuel consumption
- New LDV EV sales reach 76% by 2031, 100% by 2035 (ACC II)

Preliminary results

Buildings sector achieves nearly 20% reductions, through energy efficiency & electrification measures

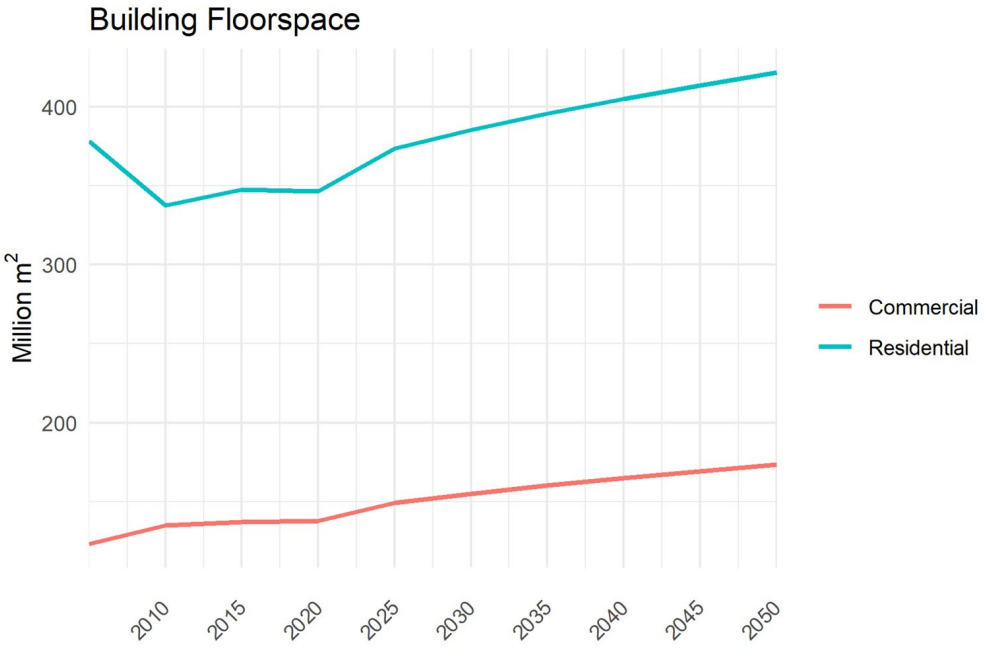


*Note: BEPS is not fully implemented in model

- Residential sector sees larger emissions reductions than commercial sector
- Gas contributes to majority of emissions, decreasing over time
- **Key policies included:** EmPower, Building Energy Performance Standards, IRA tax credits & rebates

Preliminary results

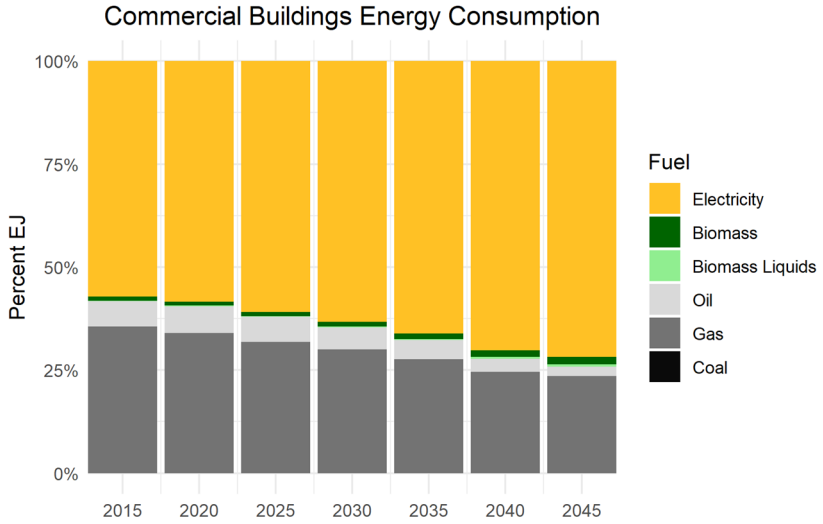
Building floorspace increases steadily from today's levels

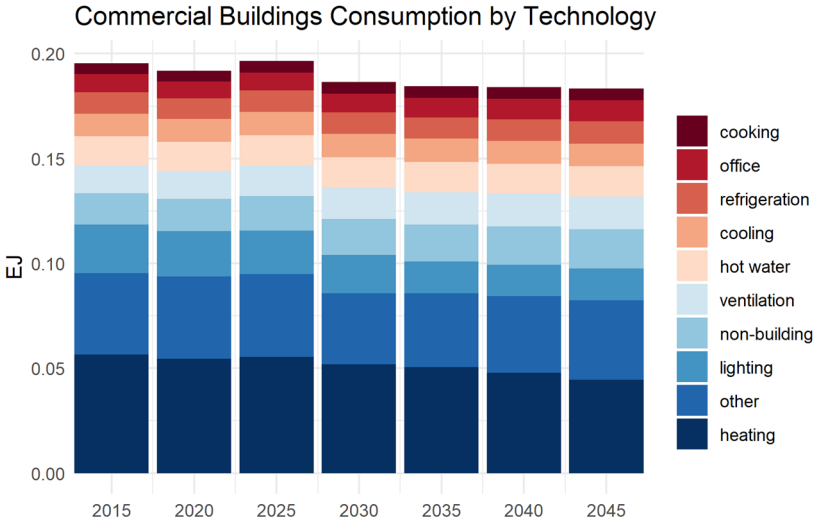


- Residential growth in line with MD department of planning projections of households
- Commercial growth in line with GDP growth

Preliminary results

Commercial buildings see increase in electrification and smaller increase in efficiency

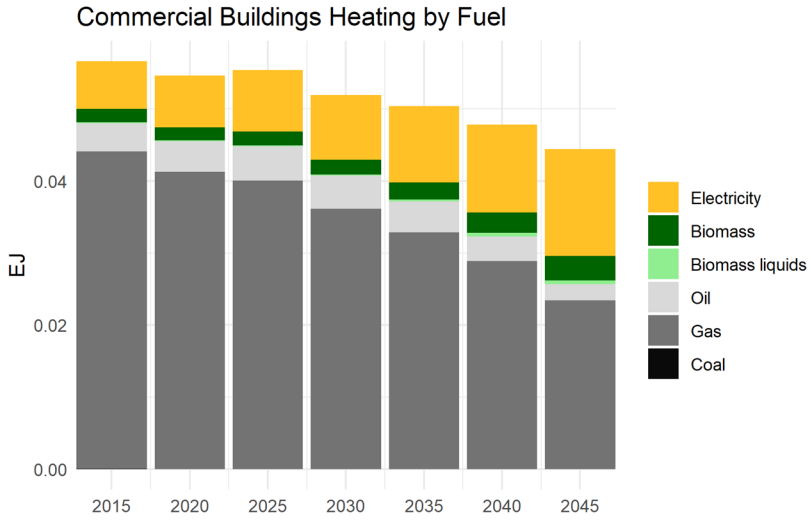


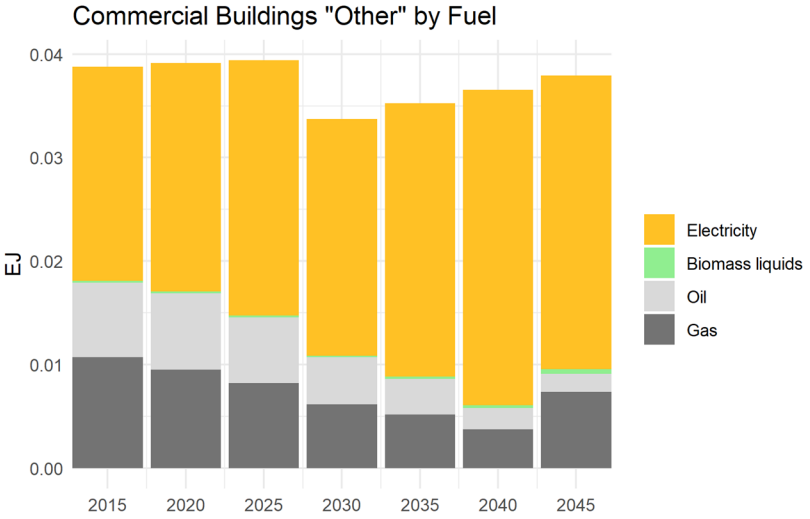


- Share of electricity increases to nearly 75% of fuel mix by 2045, as gas and oil shares decrease. Consumption slowly decreases.
- Energy consumption dominated by heating and other

Preliminary results

Energy consumption trends vary among sectors

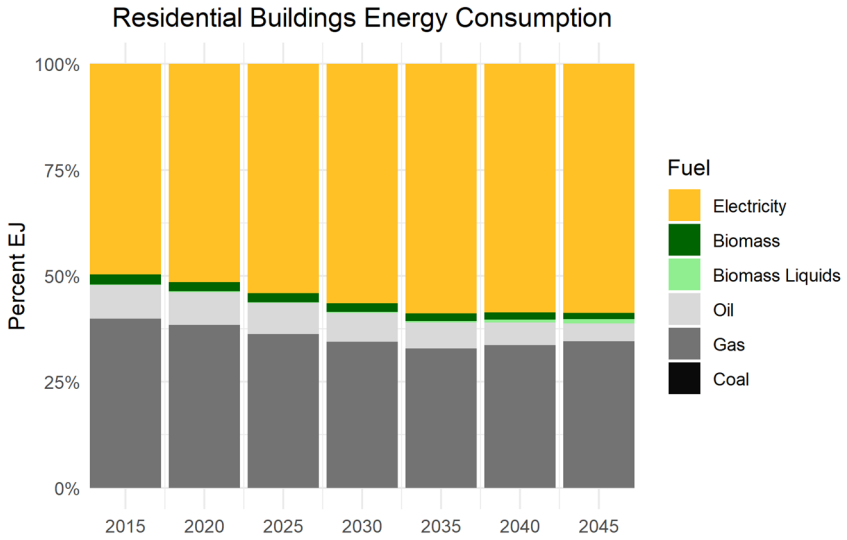


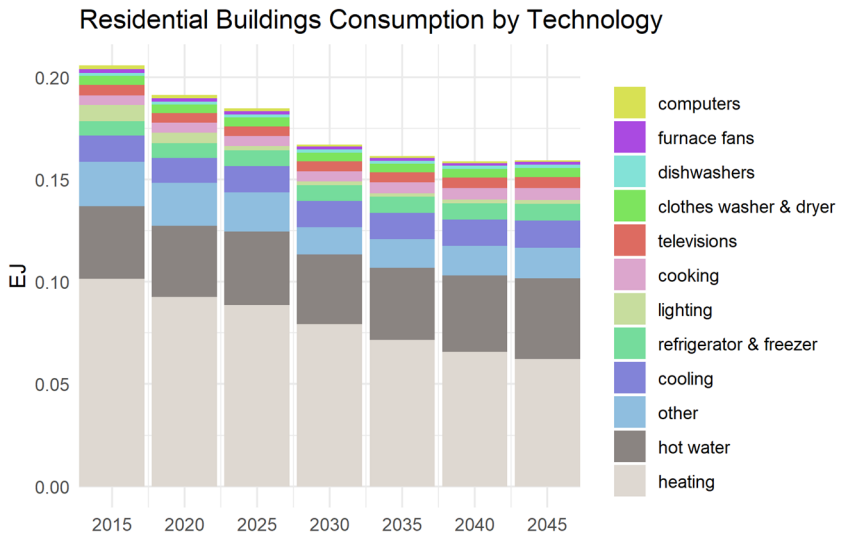


- In heating sector, electrification accelerates as overall consumption falls due to increased efficiency
- In other sector, consumption drops in 2030, then increases with more electrification
- “Other” sector includes all non-specified usage, including things like swimming pool heaters, generators, etc.

Preliminary results

Residential buildings see increase in efficiency and smaller increase in electrification

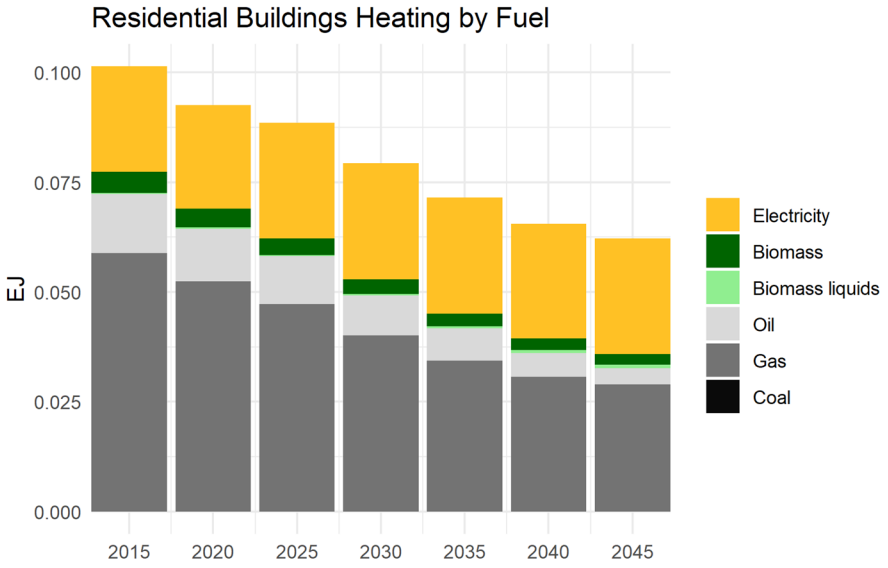


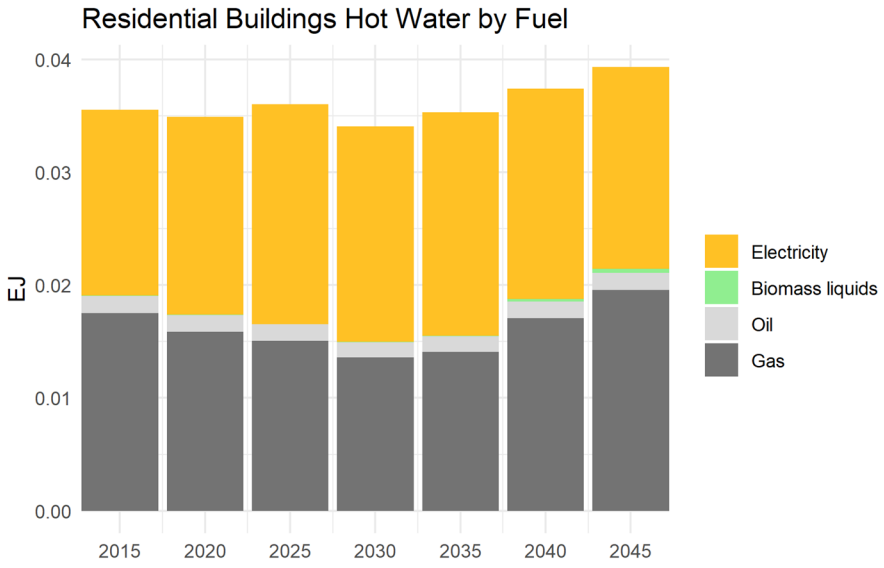


- Share of electricity increases gradually, but energy consumption decreases at a faster pace through 2030
- Energy consumption dominated by heating and hot water

Preliminary results

Energy consumption trends vary among sectors

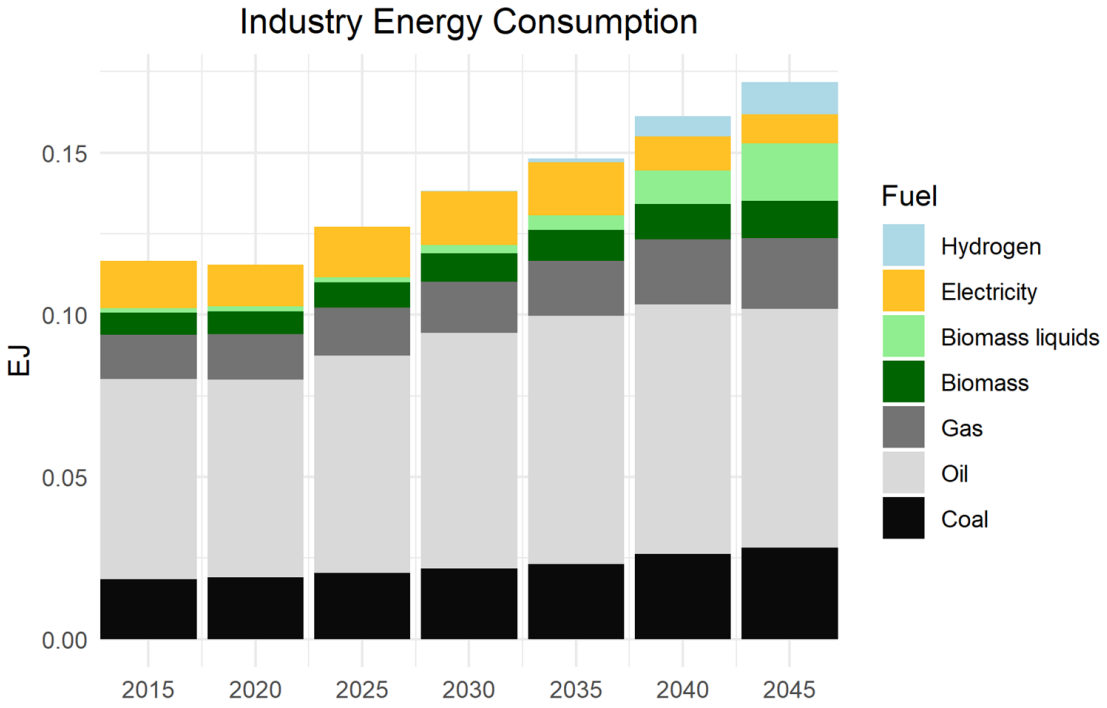




- In heating sector, electrification stays steady as overall consumption falls
- In hot water sector, consumption drops in 2030, but increases afterwards as share of gas consumption increases

Preliminary results

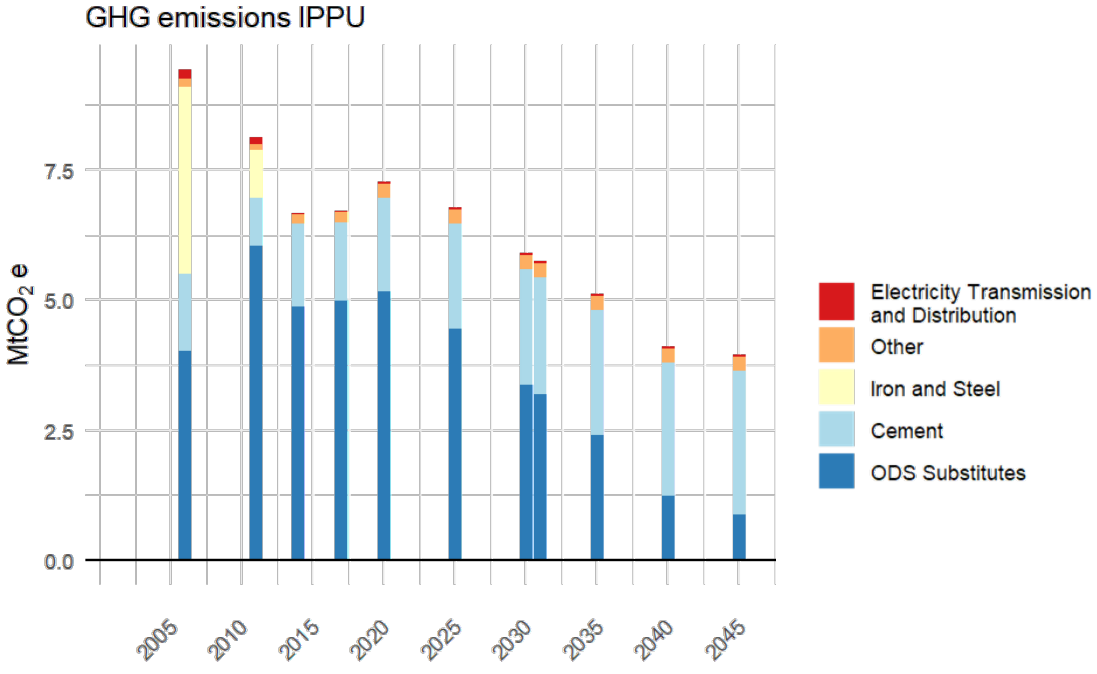
Industrial sector achieves 43% reductions below 2006 levels, primarily due to historical reductions in consumption



- Fossil fuel consumption increases with demand
- Hydrogen, biofuels, and biomass play a bigger role in later years
- **Key policies included:** emPOWER, IRA hydrogen tax credits

Preliminary results

Industrial Process and Produce Use (IPPU)



- Cement expected to become the dominant source of emissions
- Substitutes for ozone-depleting substances (ODS) expected to decrease
- **Key policies included:** AIM Act

Preliminary results

Agriculture, Forestry & Land Use

- Currently held constant at 2020 levels
- Working with state agencies to utilize state-level data to refine projections, and will incorporate results from a more targeted study using farm-level data
- Has implications for both emissions and sequestration:
  - Agriculture is a small net emissions source - unlikely to substantially change the economy-wide numbers presented here
  - Forestry and land use is a net sink - not relevant for 2031 gross emissions goal, but important for 2045 net-zero goal

Preliminary results

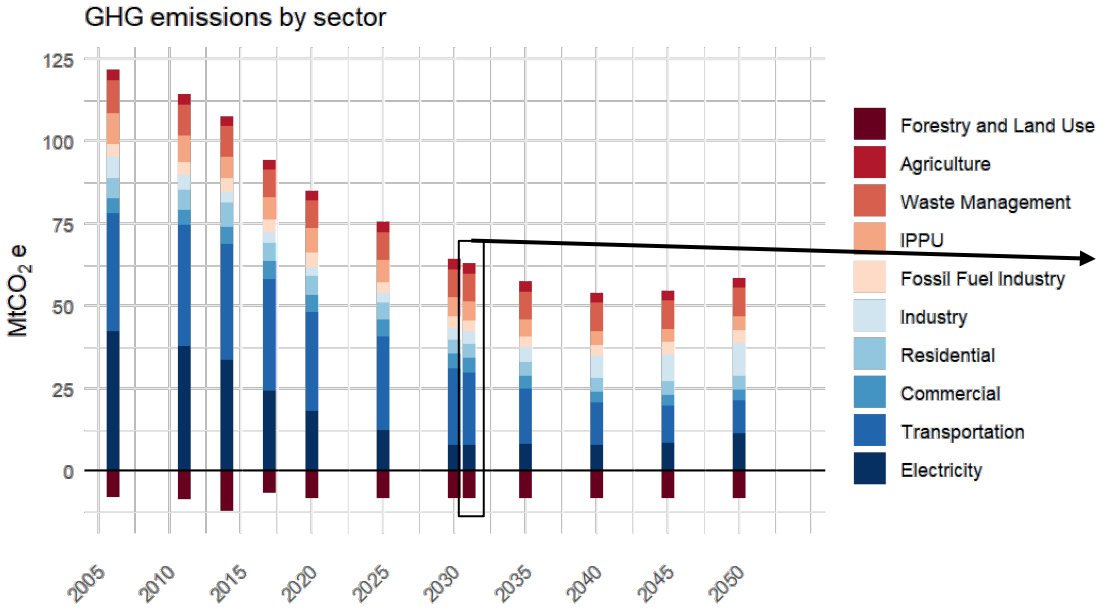
At 48% reductions, there is still a gap to meet CSNA climate targets

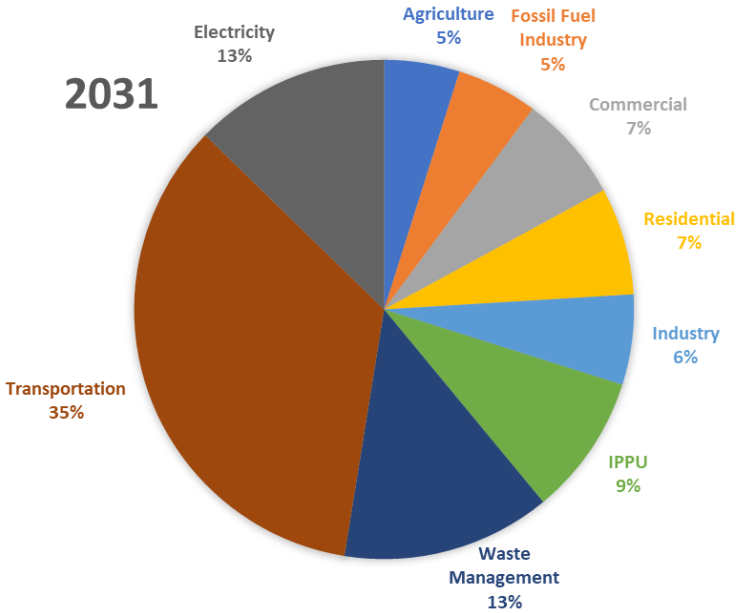
Percent emissions reductions achieved by 2031	
Economy-wide	***48%***
Transportation	38%
Electricity	81%
Buildings	19%
Industrial	43%
IPPU	39%
Fossil Fuel Industry	15%
Waste Management	15%
Agriculture	-

- 14.2 MMTCO2e additional reductions are needed to meet the 60% goal in 2031
- Only electricity meets 60% reduction target at the sector level

Preliminary results

Remaining emissions in 2031 show growing importance of small sectors





Preliminary results

CSNA scenarios

Process:

- **Step 1**: Exploratory scenario with current policies and an emissions constraint to show which sectors have room for further reductions
- **Step 2**: Core scenario that includes “Best practices” policies, drawing on our previous work for *America is All-In* where relevant
- **Step 3**: Alternative pathways with sectoral or technological variation where possible
- **Step 4**: Sensitivity analysis. Potential variations include:
    a. IRA sensitivities around tax credits, MD adoption rate, etc.
    b. Demand-side sensitivities (buildings, transportation)
    c. Variations on different state-level policies

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Thank you!

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