



SCHOOL OF
PUBLIC POLICY

CENTER FOR GLOBAL
SUSTAINABILITY

Modeling Climate Pathways in Minnesota

GCAM-USA Community of Practice
Jan 23, 2025

Agenda

- Overview of preliminary modeling scenarios
- Sectoral results
- Next steps

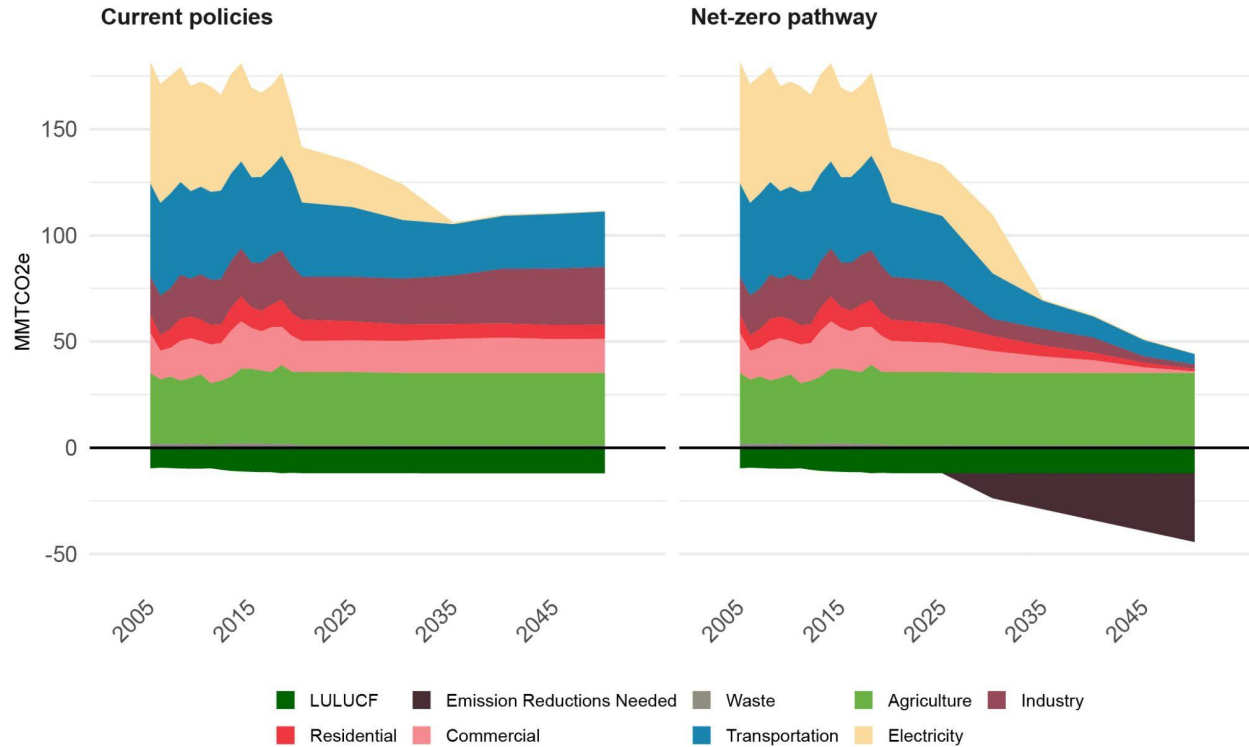
Minnesota scenario development

- Two preliminary scenarios: **Current Policies & Net-Zero**
- Current Policies scenario includes current federal and Minnesota policies.
Key policies:
 - **Power:** Minnesota RES/CES, Planned coal retirements, Nuclear relicensing, IRA incentives
 - **Transport:** IRA incentives, IIJA infrastructure funding, CAFE standards
 - **Buildings/Industry:** IRA incentives
- Net-zero scenario imposes emissions constraints consistent with Minnesota goals on top of Current Policies

State-wide emissions

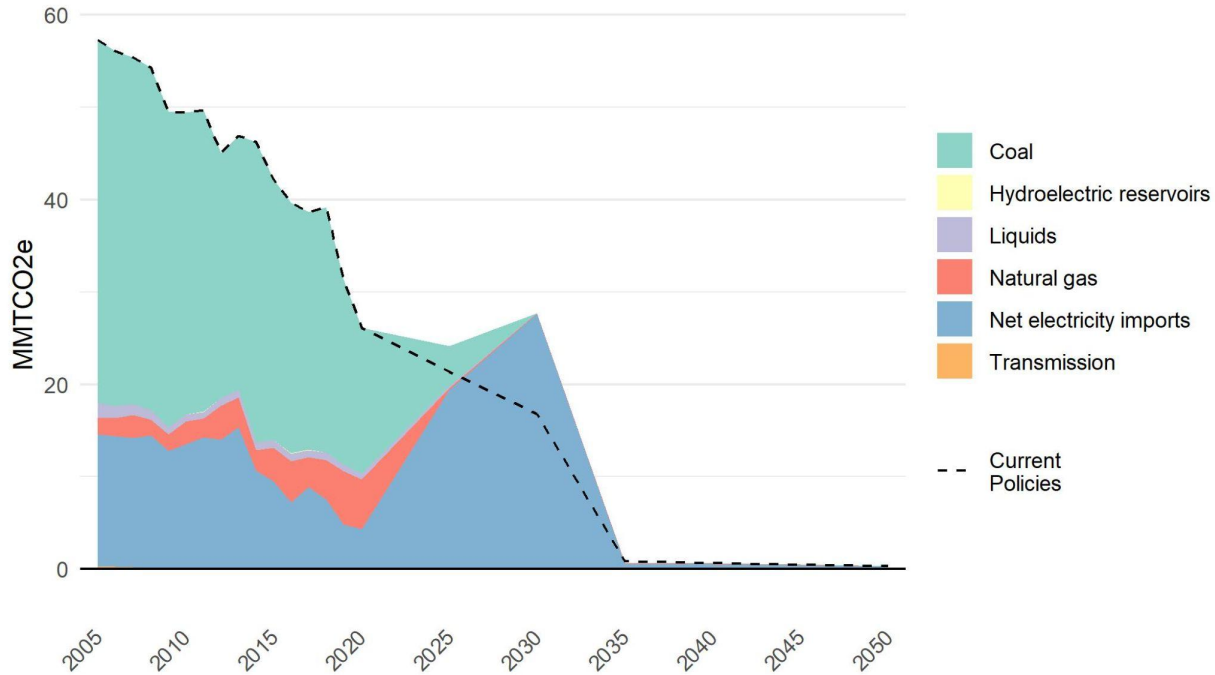
	2030	2050
Target reduction	50%	net-zero
Current Policies	35%	42%

- Currently holding Agriculture and LULUCF emissions constant until sectoral modeling is available



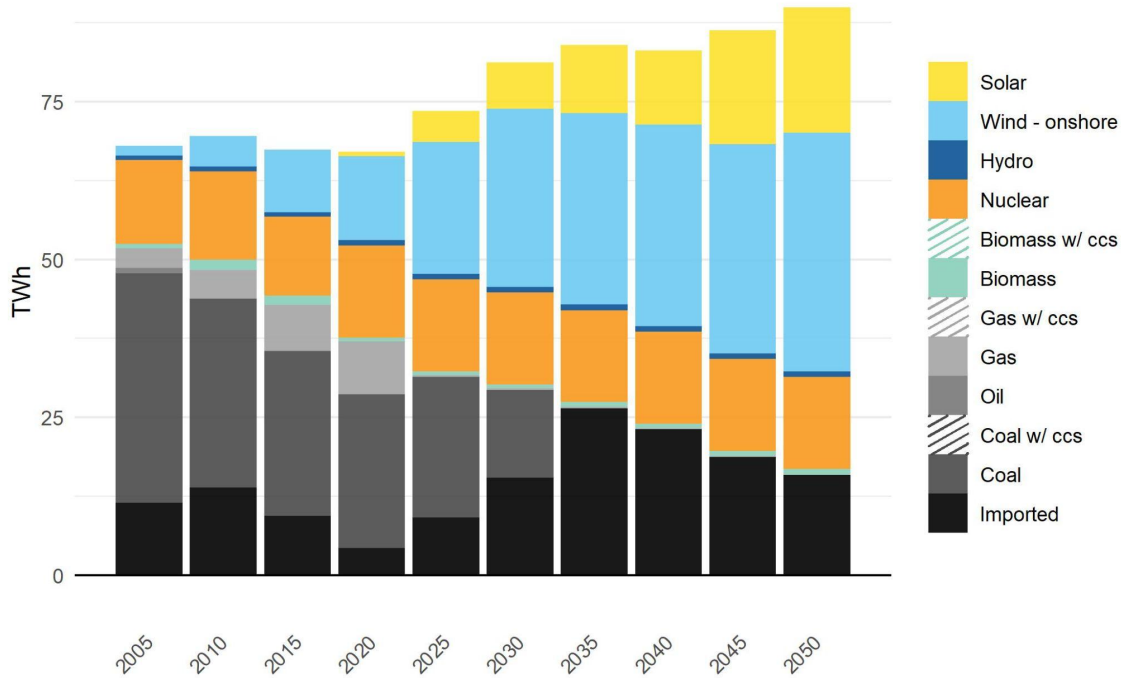
Preliminary results

Electricity sector emissions



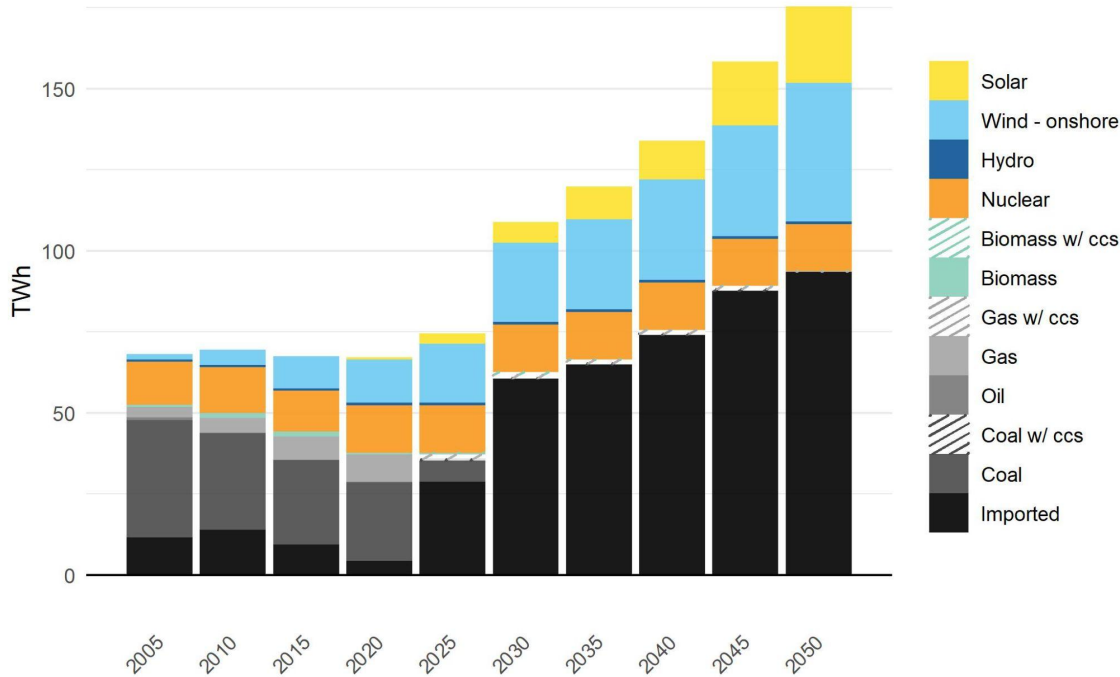
- 100% clean energy standard by 2040
- Imported electricity emissions based on PUC guidance: MISO subregion average and PPA's

Electricity generation - Current Policies



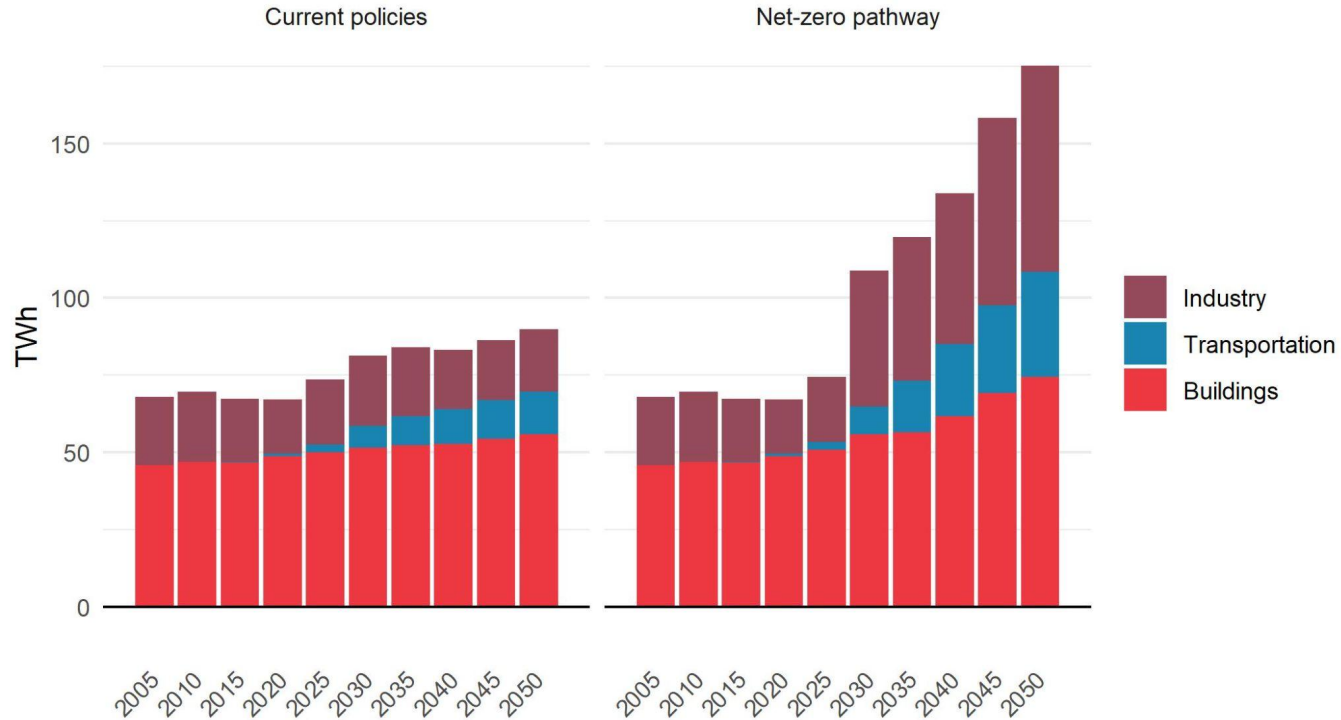
- Electricity imports rise in near-term years, then fall as more in-state renewables are built
- Existing nuclear assumed to be relicensed, but no new generation

Electricity generation - Net-zero



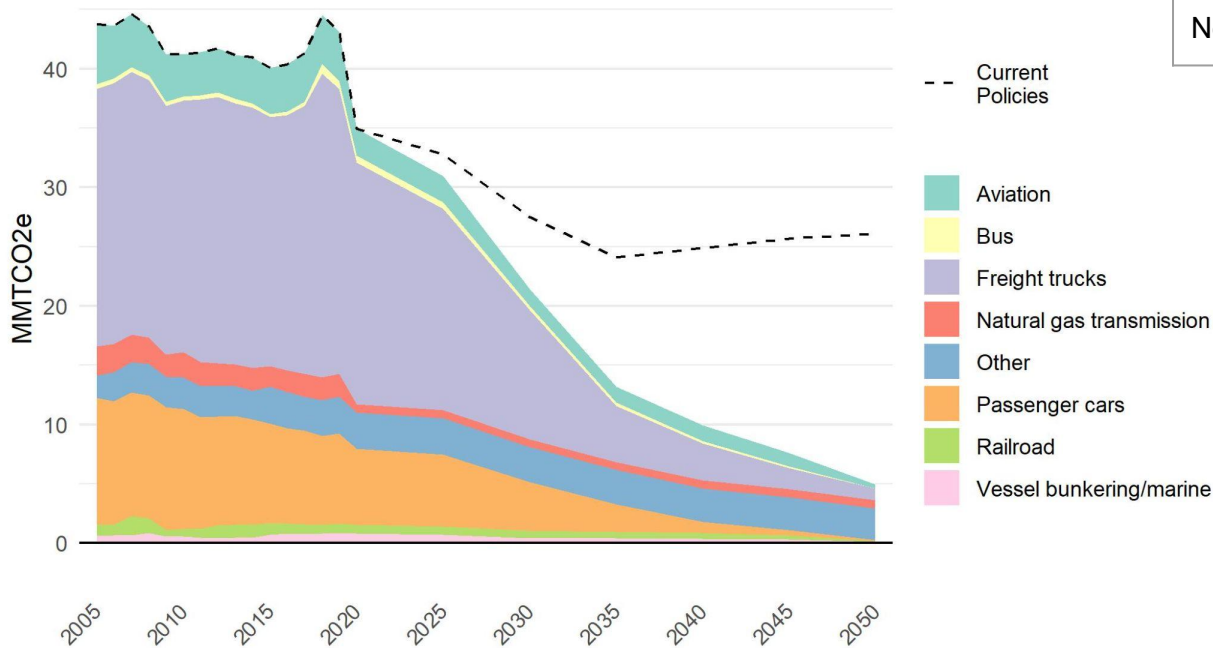
- Electricity mix more reliant on imports under net-zero constraints due to rising demand
- Imports modeled as compliant with CES requirements

Significant growth in electricity consumption driven by electrification



Preliminary results

Transportation sector emissions

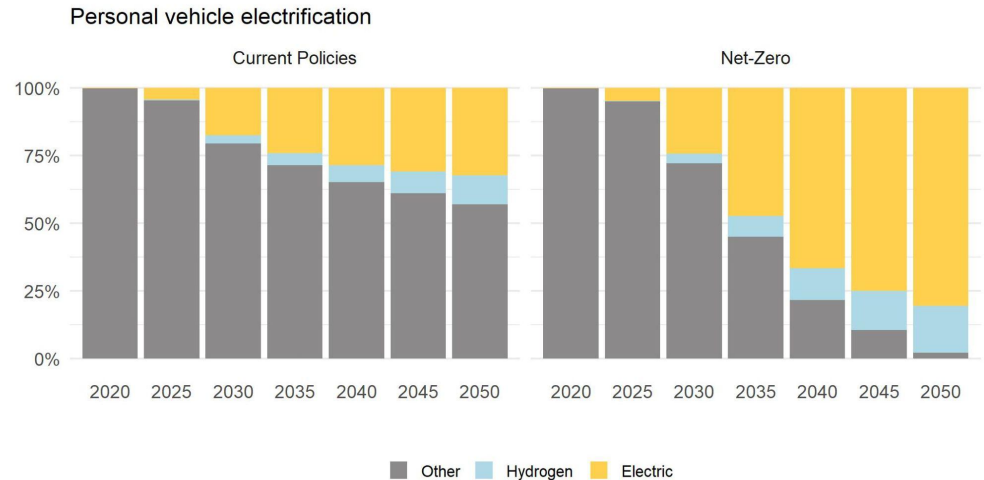
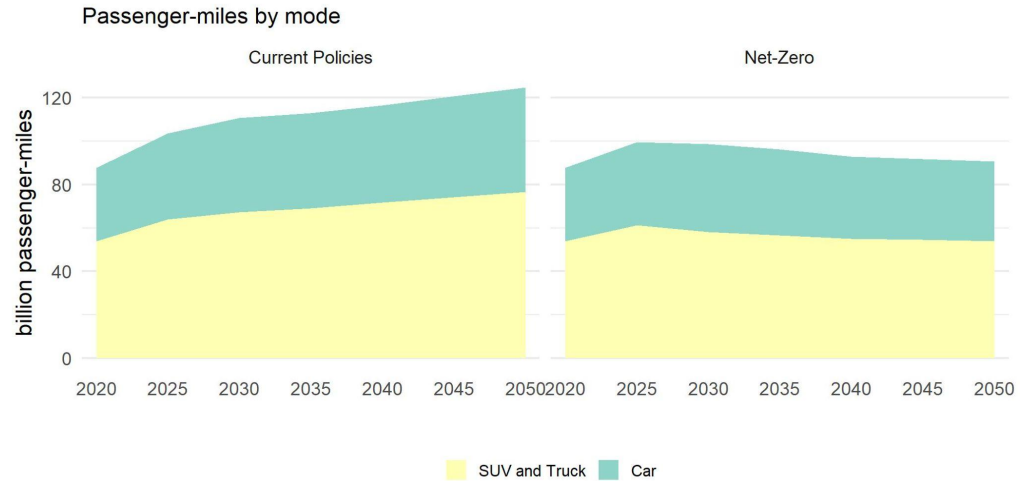


	2030	2040	2050
Target reduction	50%	80%	net-zero
Current Policies	37%	43%	40%
Net-Zero	51%	77%	89%

- Minnesota also has VMT reduction per capita goals that are modeled as applying to passenger vehicles

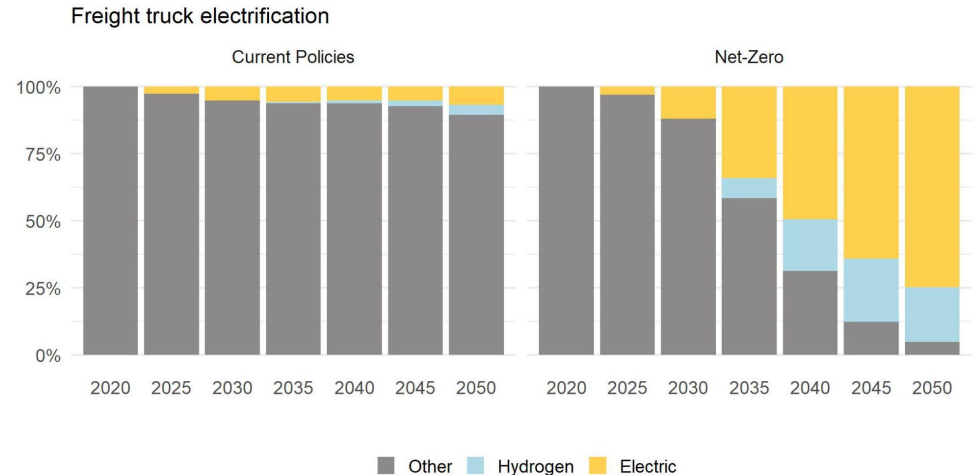
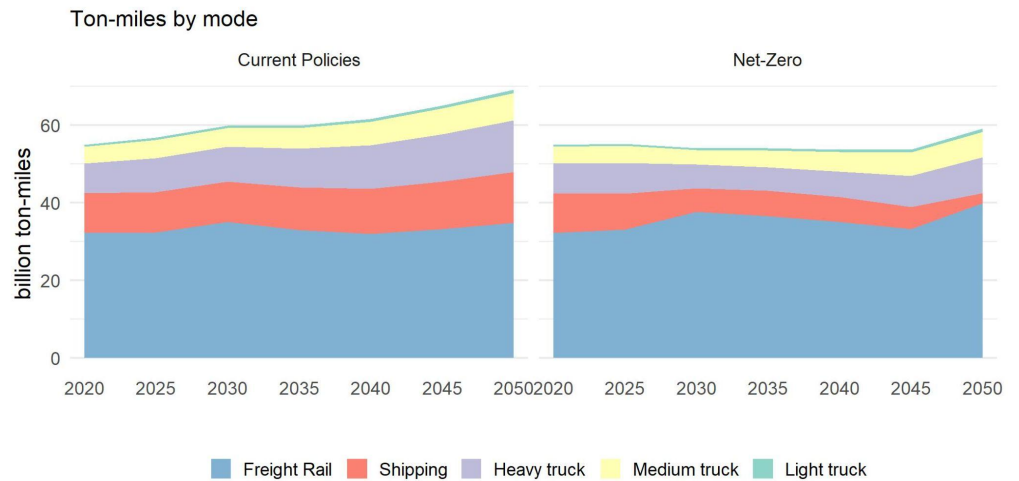
Passenger transportation

- 23% VMT reductions per capita by 2050
- Passenger vehicles electrify rapidly, with a smaller potential role for other ZEV technologies



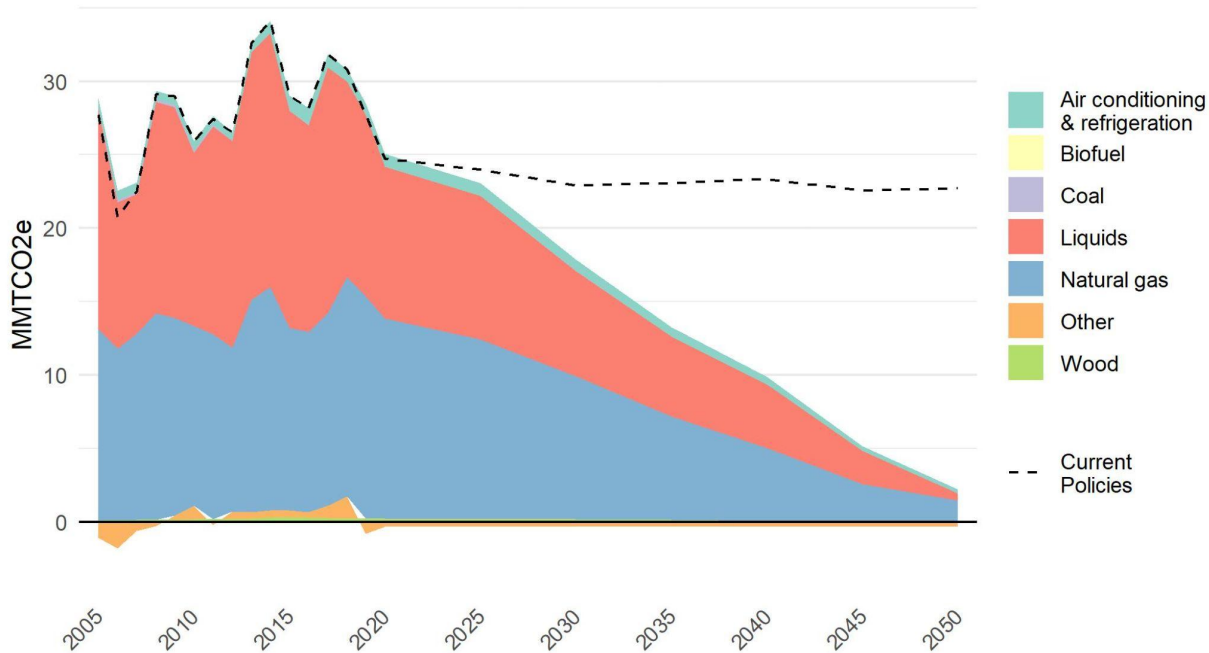
Freight transportation

- Freight is the largest contributor to transportation emissions
- Rapid electrification and VMT reductions likely needed for net-zero



Preliminary results

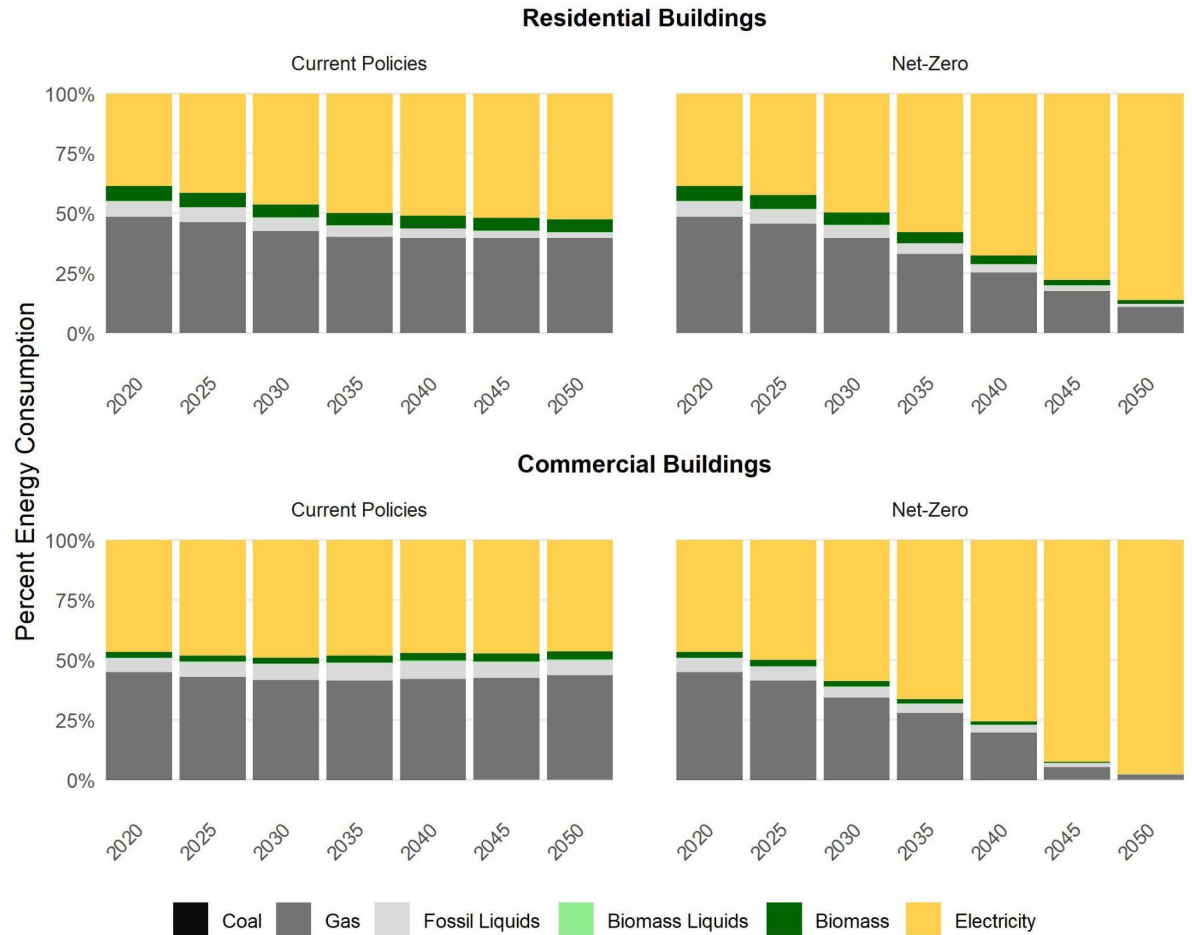
Buildings sector emissions



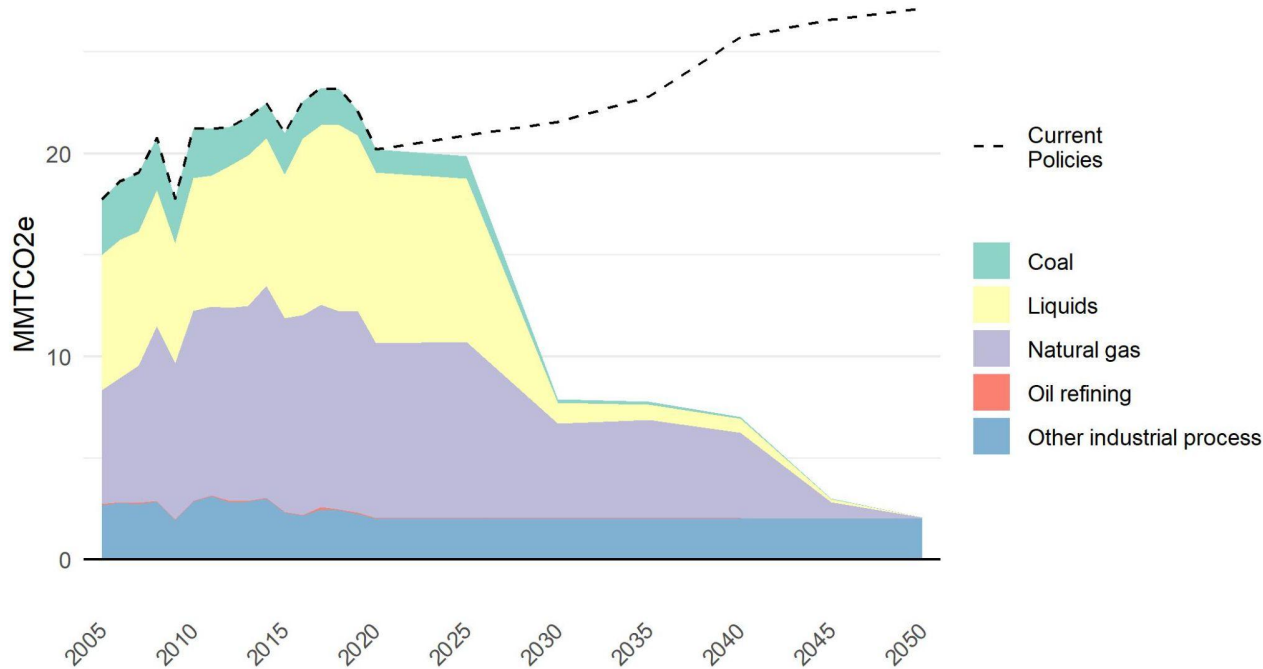
- Substantial reductions needed, primarily from reducing use of natural gas and fossil liquids in buildings

Buildings sector energy use

- Residential and Commercial buildings both electrify rapidly under emissions constraint
- Remaining fossil fuel use primarily heating and hot water

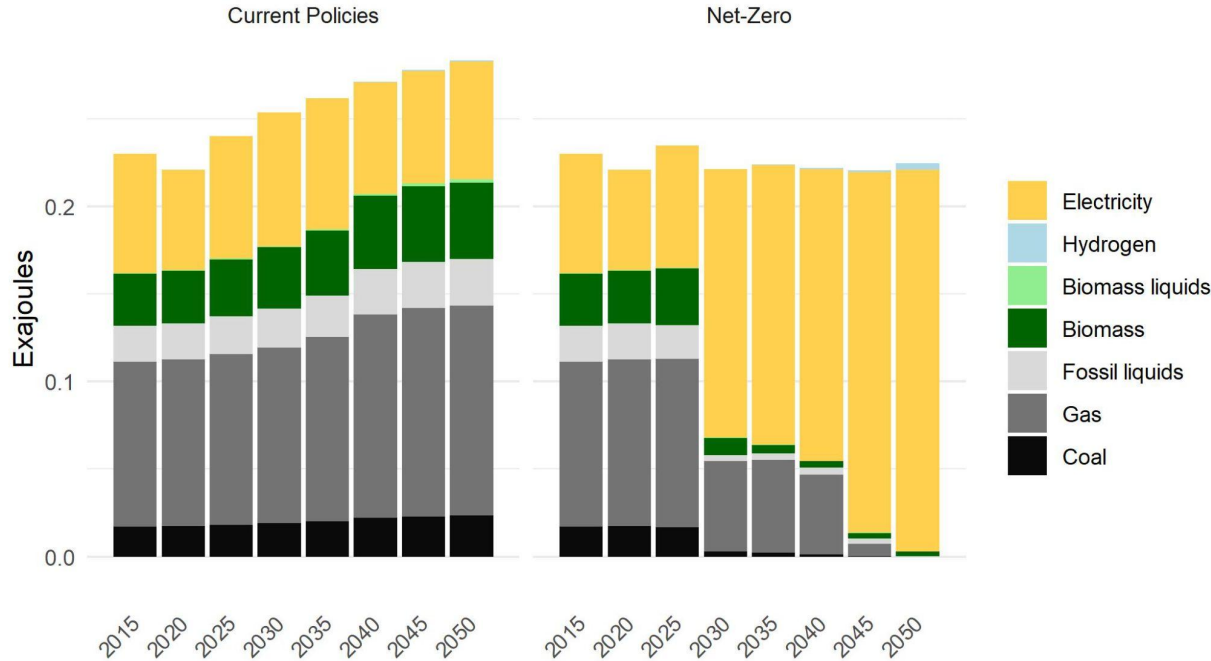


Industrial sector emissions



- Difficult-to-abate sector that may struggle to fully eliminate emissions
- Sector currently reducing emissions fast to compensate for AFOLU and other residual emissions

Industrial sector energy use



- Emissions constraint keeps energy use flat over time
- Steep electrification may not be possible in the short term
- Other sectors may need to move faster for 2030 target

Next Steps

- Waste, Agriculture, and LULUCF sectors currently held constant
 - Waste sector endogenized with GCAM version update
 - Agriculture analysis will be done separately in COMET-Farm and combined through post-processing
 - Exploring options for LULUCF, but continuing to hold constant in ongoing scenarios
- Impact analysis
 - Connecting GCAM with COBRA for health impact analysis
 - Connecting GCAM with REMI for economic impact analysis



SCHOOL OF
PUBLIC POLICY

CENTER FOR GLOBAL
SUSTAINABILITY

Thank you!

Dr. Kathleen Kennedy, Assistant Research Professor, Center for Global Sustainability, University of Maryland School of Public Policy,
kmkenne5@umd.edu

Camille Wejnert-Depue, PhD Student, Center for Global Sustainability, University of Maryland School of Public Policy

Bradley Phelps, Post-masters Research Associate, Center for Global Sustainability, University of Maryland School of Public Policy

Dr. Steve Smith, Senior Fellow, Center for Global Sustainability, University of Maryland School of Public Policy;
Earth Scientist, JGCRI/PNNL

Prof. Ryna Cui, Research Director, Center for Global Sustainability and Assistant Research Professor, University of Maryland School of Public Policy