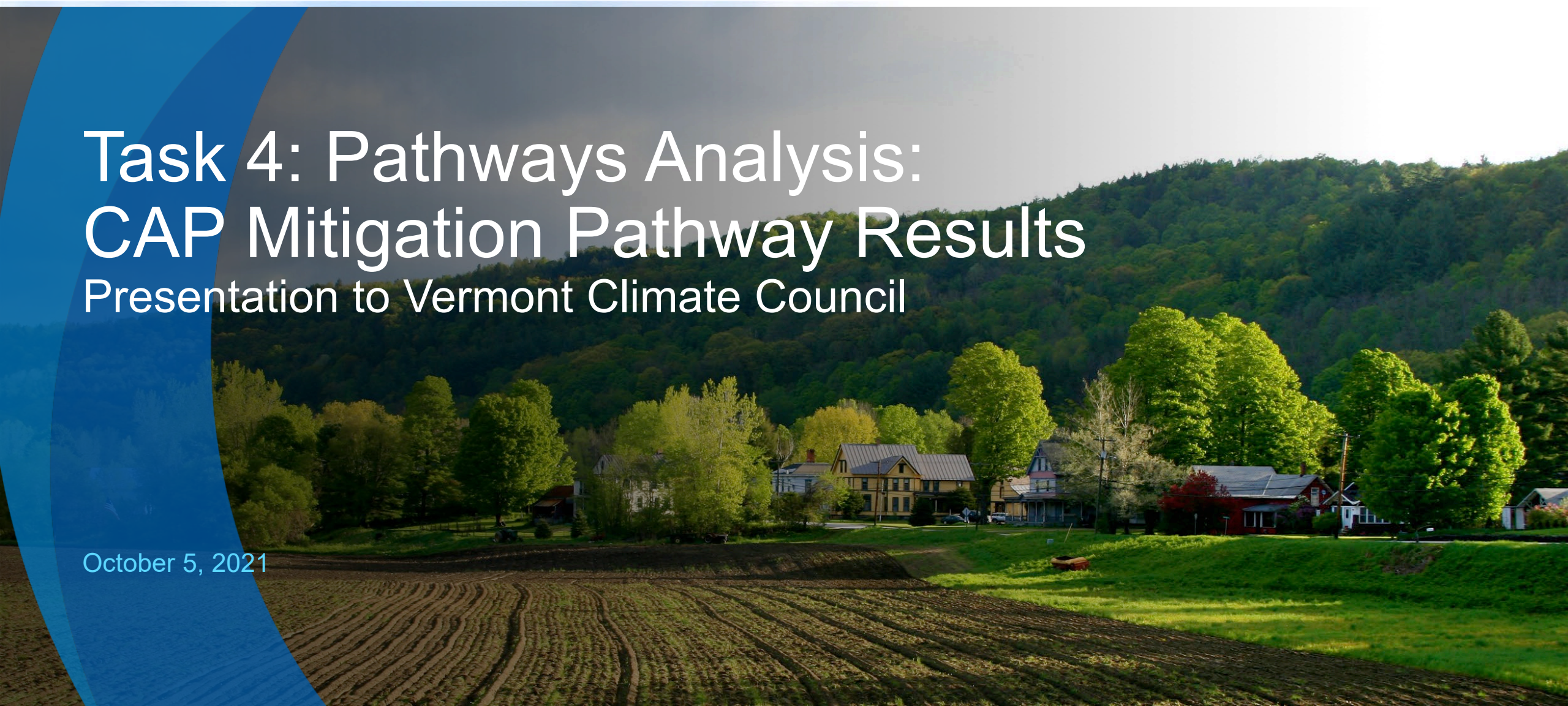


CADMUS

Task 4: Pathways Analysis: CAP Mitigation Pathway Results Presentation to Vermont Climate Council

October 5, 2021



Agenda

- CAP Mitigation Scenario
- Sector Analysis
 - Transportation
 - Buildings
 - Non-Energy
 - Electricity
- Cross-Cutting Considerations
- Questions and Discussion



CAP Mitigation Scenario

Pathways Analysis

Build upon analyses completed by the State and Stockholm Environment Institute to deliver:

Task 4a: Initial Pathways Analysis (Sept. 30)

Recommendations and Excel table:

- Sectoral, jurisdictional and existing climate initiatives
- Impact of the VCC recommended strategies on emissions reductions
- Preliminary 2025, 2030 and 2050 pathway recommendations and corresponding LEAP inputs

Task 4b: Draft and Final Pathways Report and Executive Summary (Nov. 15)

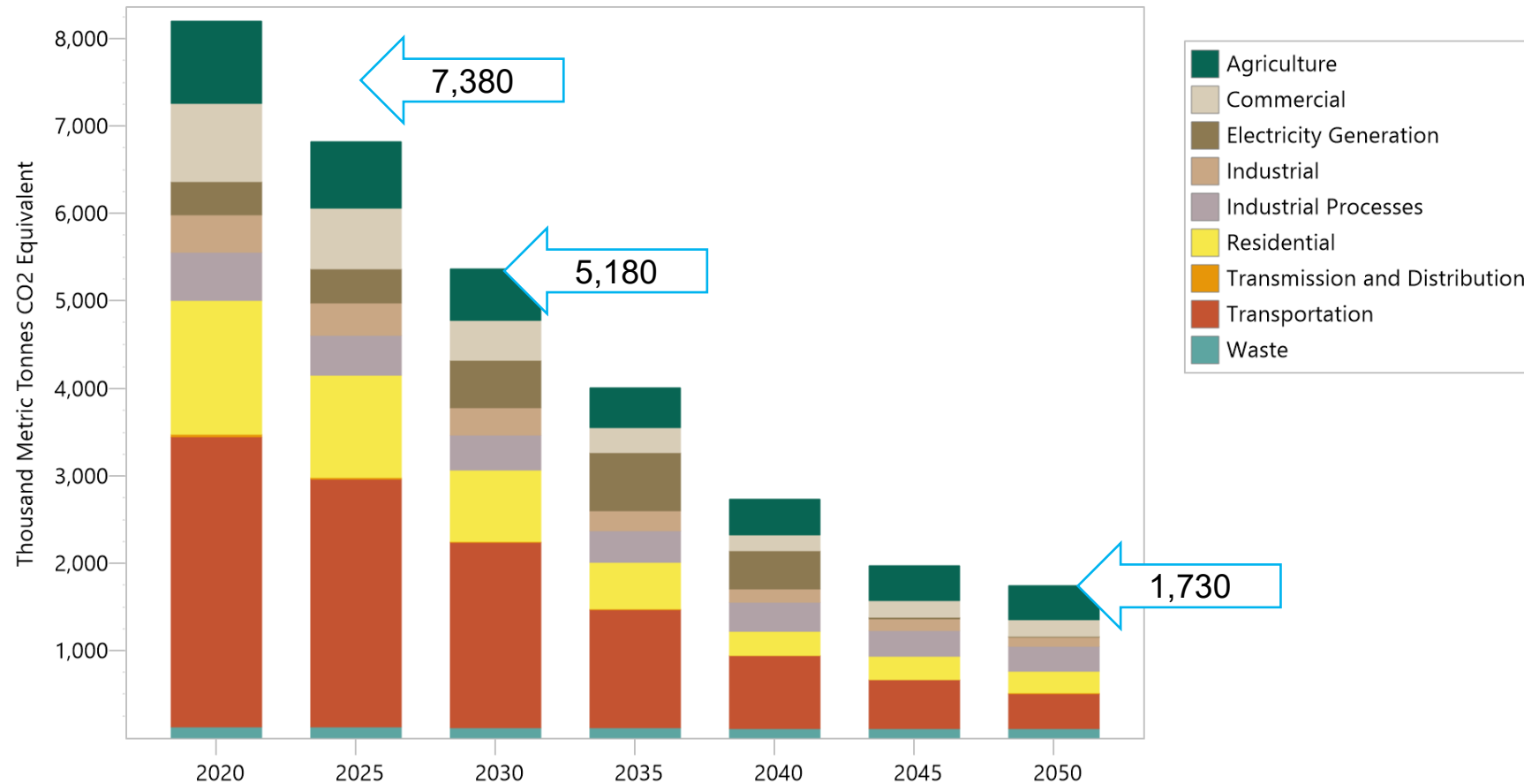
- 2025 Pathway: Immediate and short-term policies, programs, and initiatives to meet reduction targets.
- 2030 Pathway: Additional policies, programs, and initiatives to be advanced this decade to meet reduction targets.
- 2050 Pathway: Strategic framework for additional activities necessary to achieve 2050 emissions targets.

Deliverables

50-page report, 10-page Executive Summary

CAP Mitigation Scenario and GWSA Targets

100-Year GWP: Direct (At Point of Emissions)
Scenario: Mitigation Pathway, All Fuels, All GHGs, All Urban Rurals

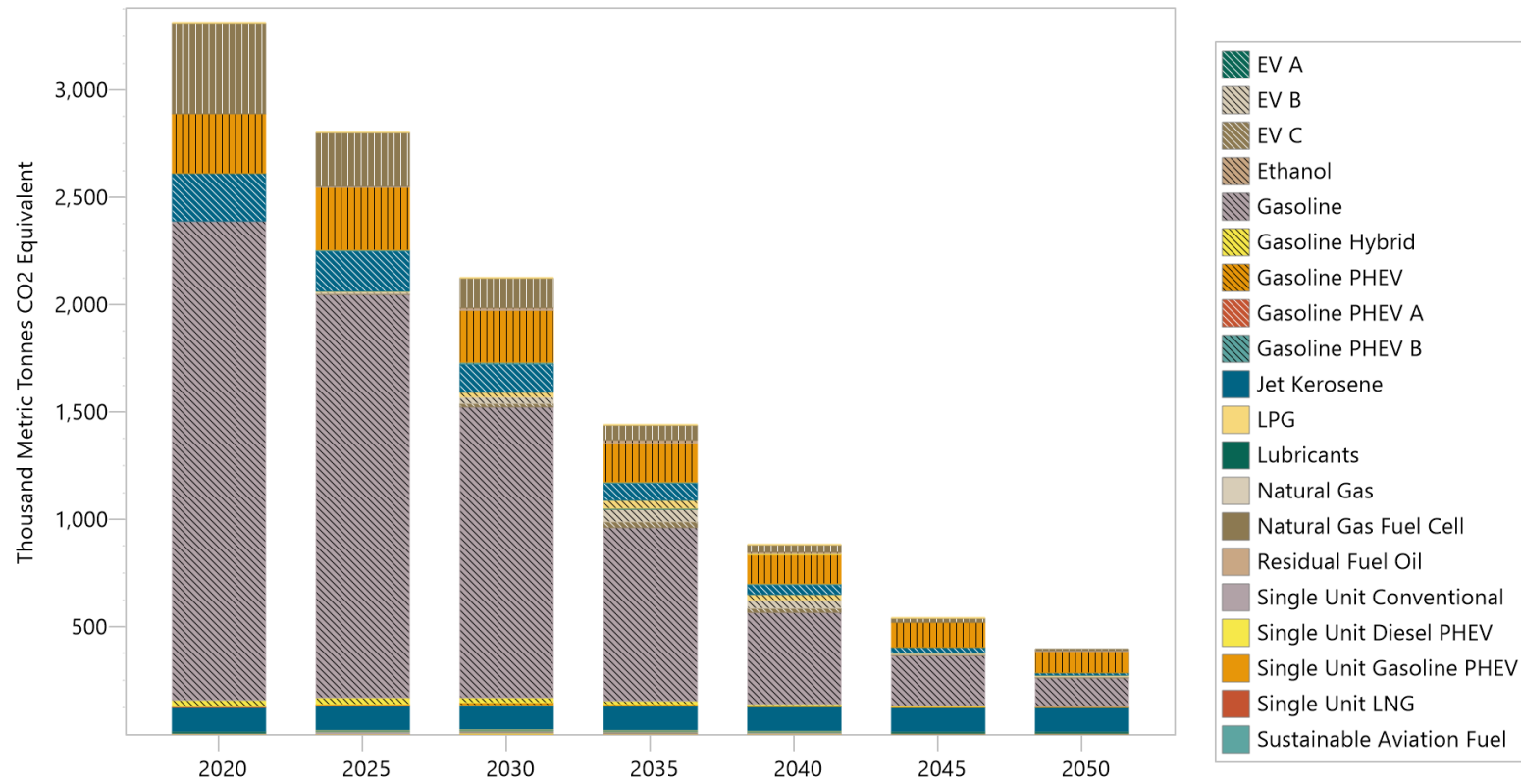




Sector Modeling Transportation

Transport Sector – CAP Mitigation Scenario

100-Year GWP: Direct (Demand) plus Indirect (Transformation) Emissions Allocated to Demands
 Scenario: CAP Mitigation Pathway, All Fuels, All GHGs, All Vehicle Types



Sector Emission Reductions:

- 15% by 2025
- 36% by 2030
- 88% by 2050

Primarily from Electric Vehicles

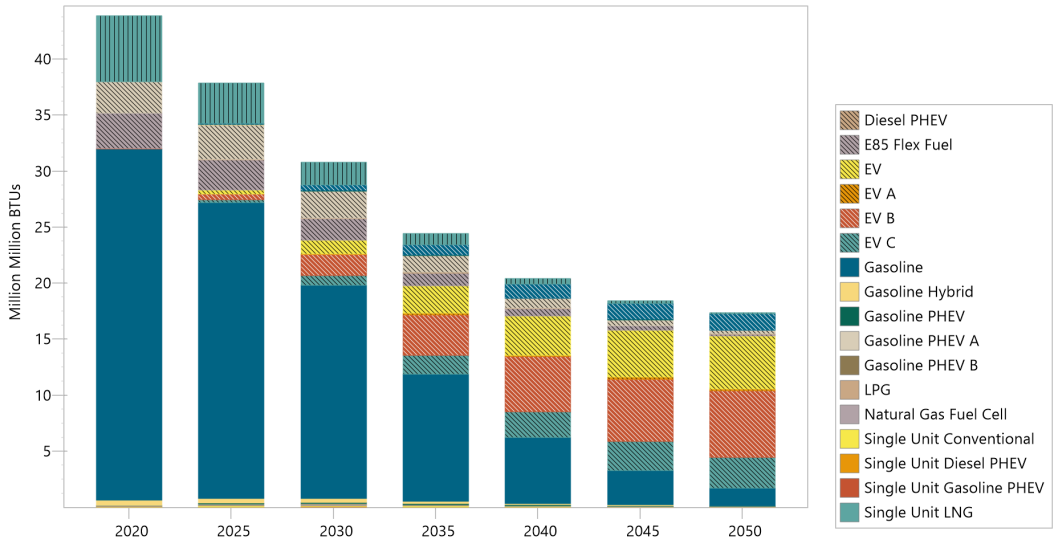
Increased efficiency
 Cleaner fuel

Other contributors

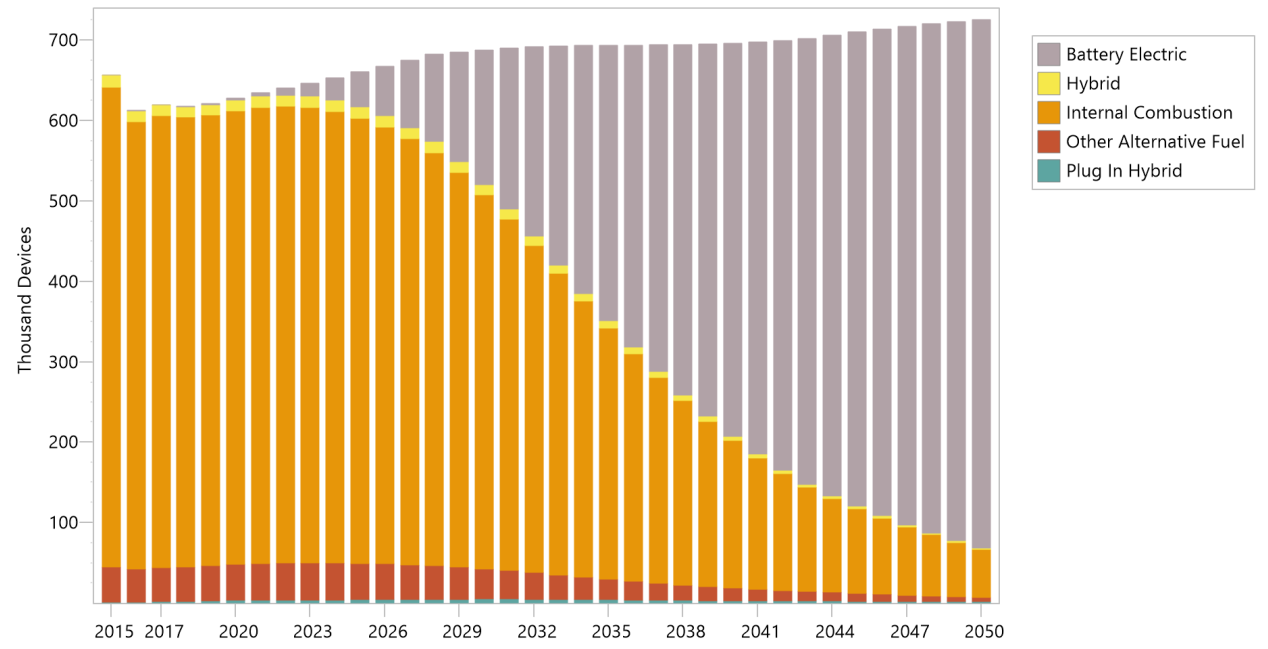
Biofuels
 VMT reductions

Transport Sector – CAP Mitigation Scenario

Energy Demand Final Units
Scenario: CAP Mitigation Pathway, All Fuels, All Vehicle Types



Device Stocks
Scenario: CAP Mitigation Pathway, All Vintages



Transport: Pathway Key Policies, Strategies & Actions

CAP Mitigation Scenario Supports:
Transportation Climate Initiative, and
associated initiatives such as:

- Replace your Ride
- Transit
- Smart growth and other Transportation Demand Management, and
- Feebates

Additional supporting analyses (e.g on customer financial incentives/adoption rates, and public costs of initiatives under consideration) to be included in Pathways Report.

TCI Program Goals

- Reduce carbon dioxide (CO₂) emissions from transportation sources
- Improve air quality and public health, increase resilience to the impacts of climate change, and provide more affordable access to clean transportation choices
- Promote local economic opportunity and create high quality jobs
- Maximize the efficiency of this multijurisdictional program to ensure greater benefits
- Advance equity for communities overburdened by pollution and underserved by the transportation system

Source: TCI-P MOU, Dec. 2020
(<https://www.transportationandclimate.org/sites/default/files/TCI%20MOU%2012.2020.pdf>)



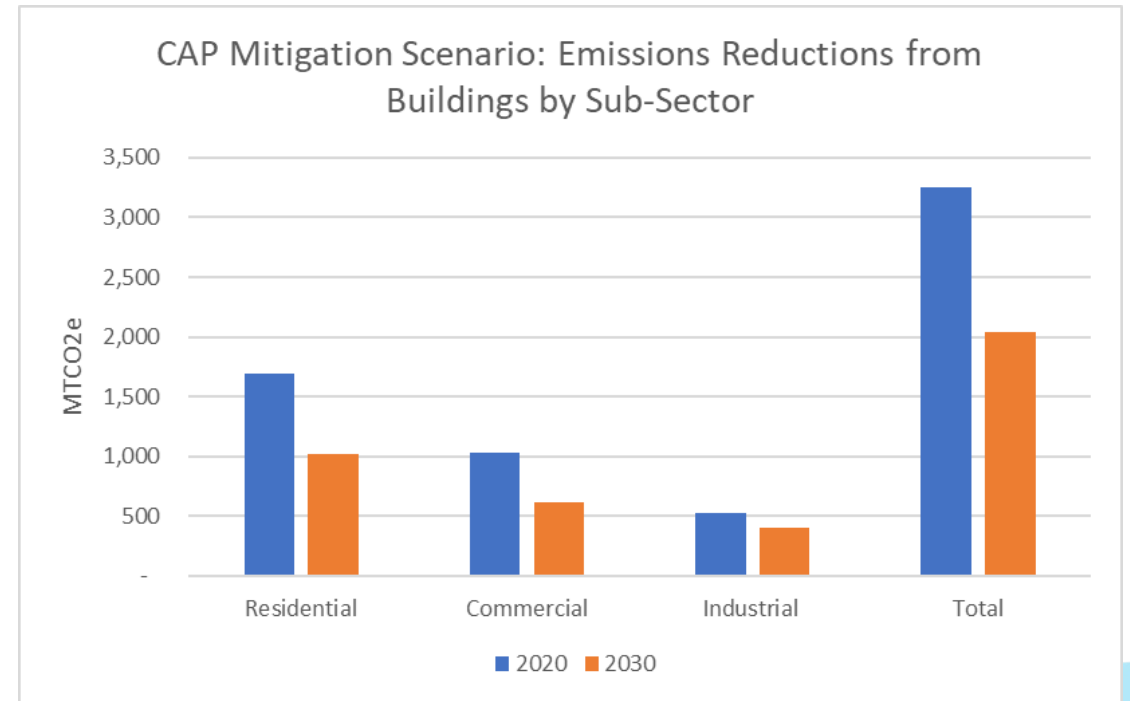
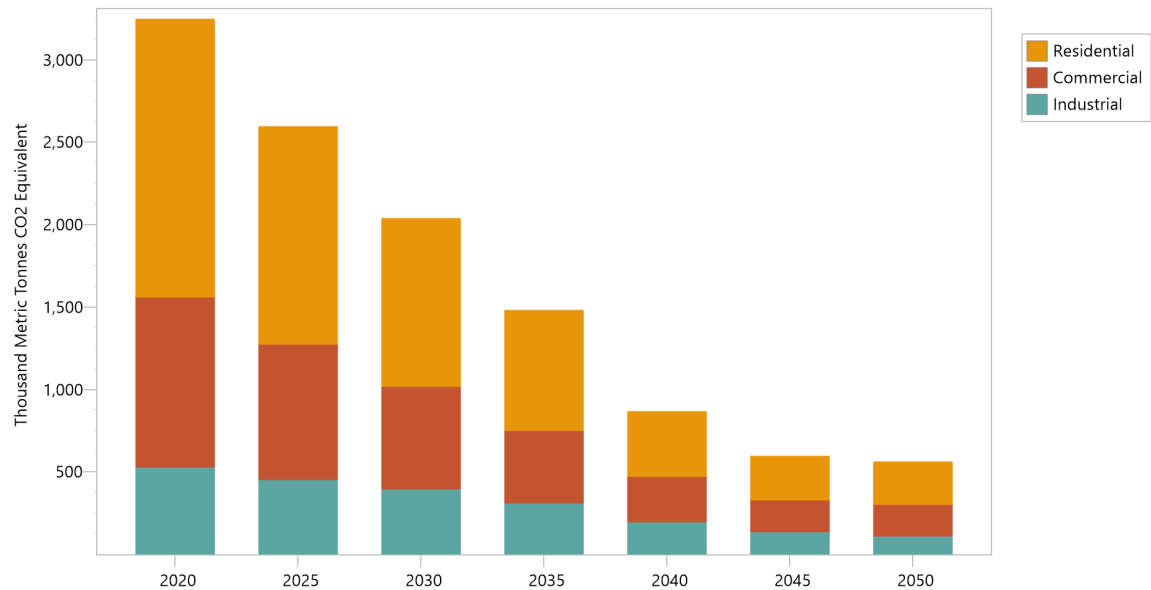
Source TCI-P updates program webinar, March 2021



Sector Modeling Buildings

Buildings Sector – CAP Mitigation Scenario

100-Year GWP: Direct (Demand) plus Indirect (Transformation) Emissions Allocated to Demands
Scenario: Mitigation Pathway, All Fuels, All GHGs

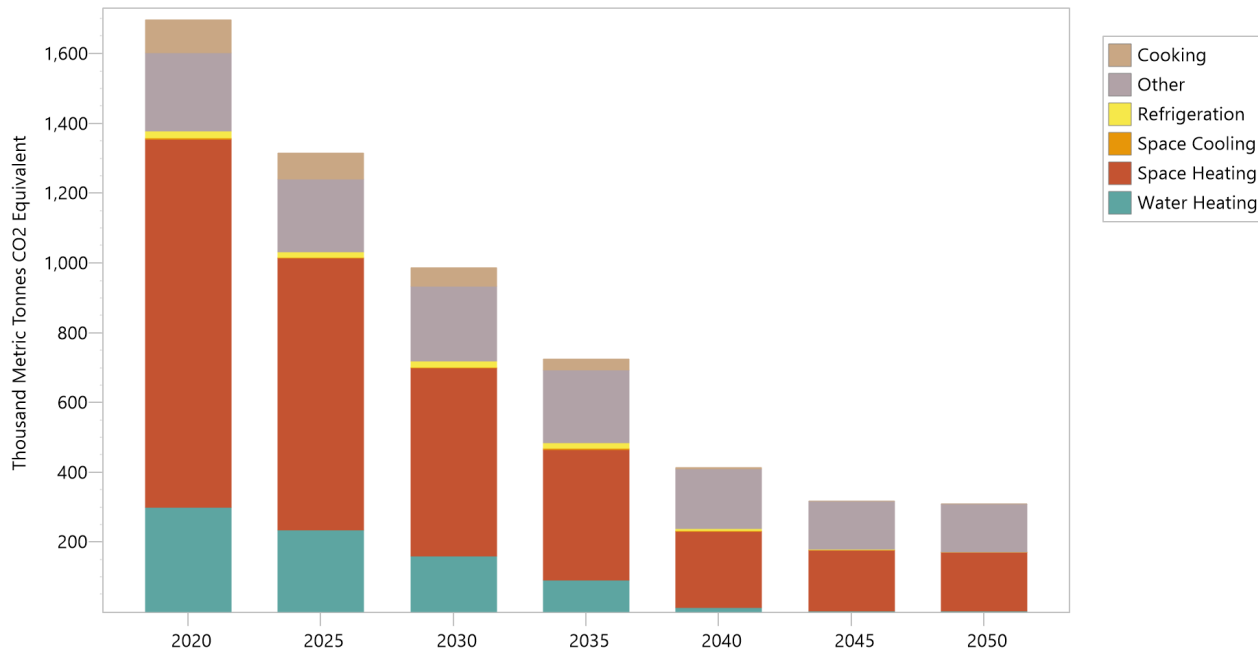


Emissions reductions from 2020 to 2030 37%, and by 2050 83%.

~55% from residential, 33% Commercial, 12% Industrial

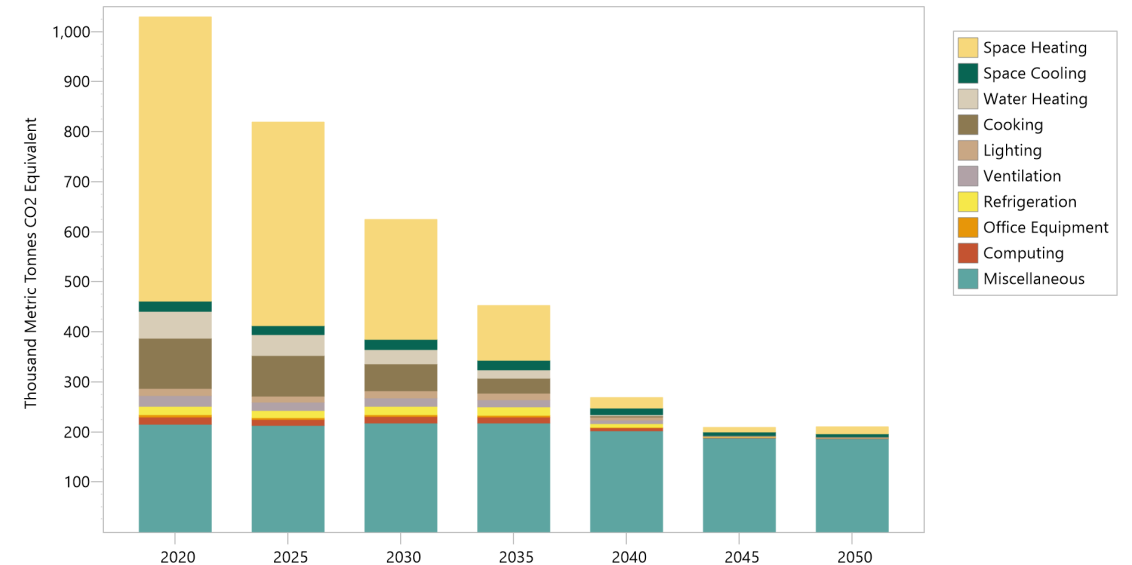
Buildings Sector – CAP Mitigation Scenario

100-Year GWP: Direct (Demand) plus Indirect (Transformation) Emissions Allocated to Demands
 Scenario: CAP Mitigation Pathway, All Fuels, All GHGs, All Urban Rurals, All Tenures, All Housing Structures



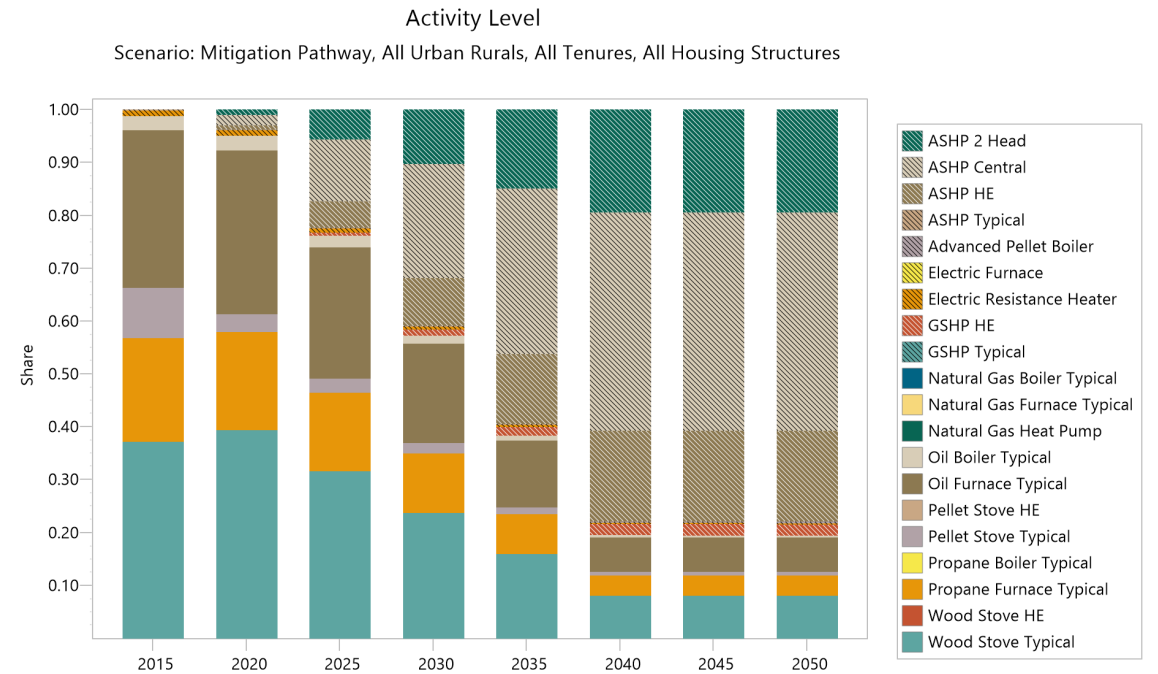
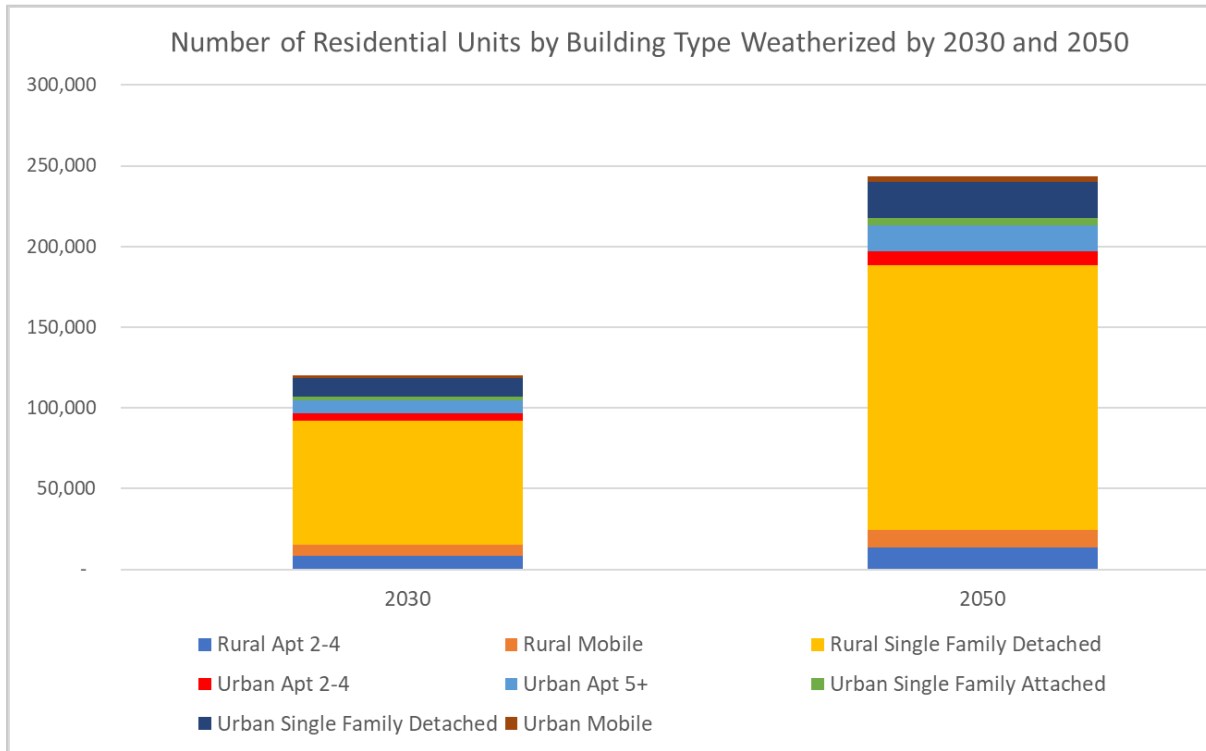
Residential, primarily space heating
 Heat pumps, shell efficiency.
 Phase out of fossil cooking and water heating

100-Year GWP: Direct (Demand) plus Indirect (Transformation) Emissions Allocated to Demands
 Scenario: CAP Mitigation Pathway, All Fuels, All GHGs



Commercial, primarily space heating
 Heat pumps, phase out of water and cooking fossil .

Residential Sub Sector – Weatherization and Heat Pumps – CAP Mitigation Scenario

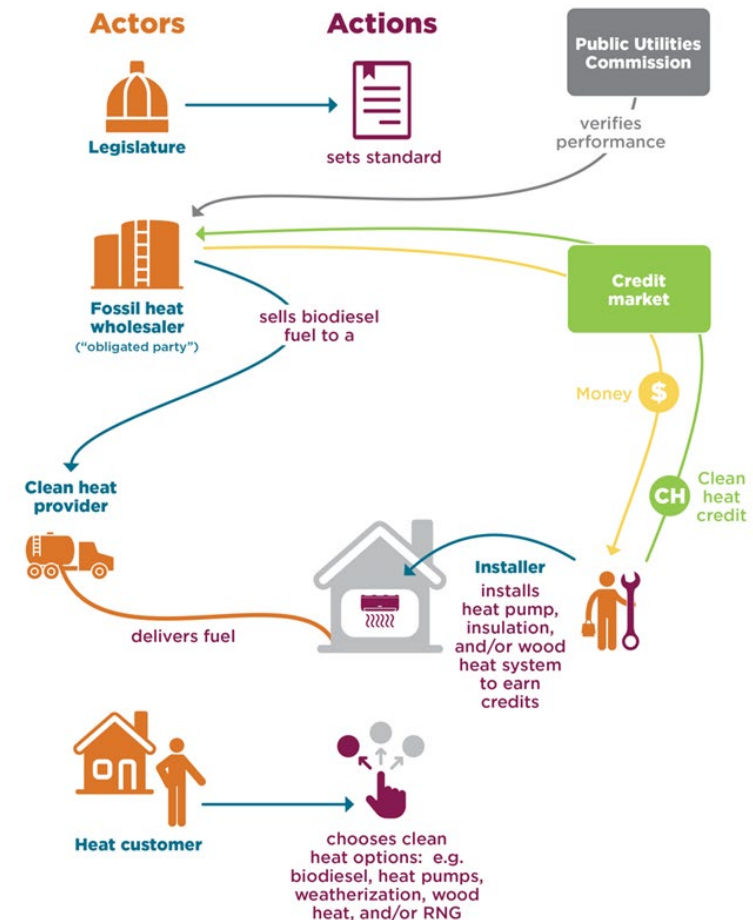



Buildings: Pathway Key Policies, Strategies & Actions

CAP Mitigation Pathway is consistent with and provides analytic support for evaluation of:

- Clean Heat Standard,
- Rental Efficiency Initiative,
- Weatherization at scale,
- Fossil cooking and water heating phase out,
- Net zero new construction standards for residential and commercial,
- Increased demand response and coordinated load management

Clean Heat Standard: Sample Process

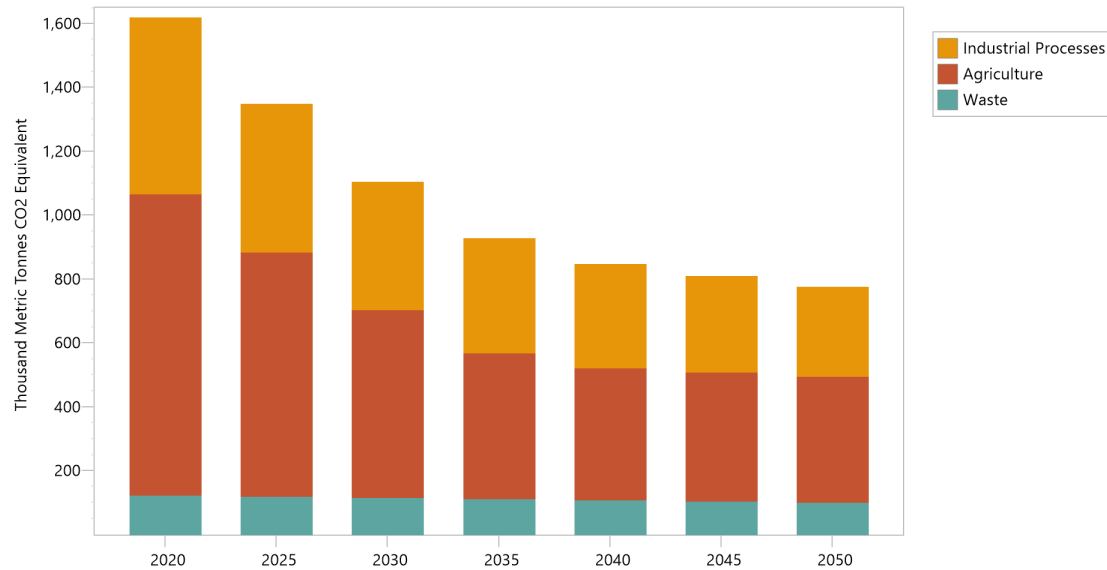




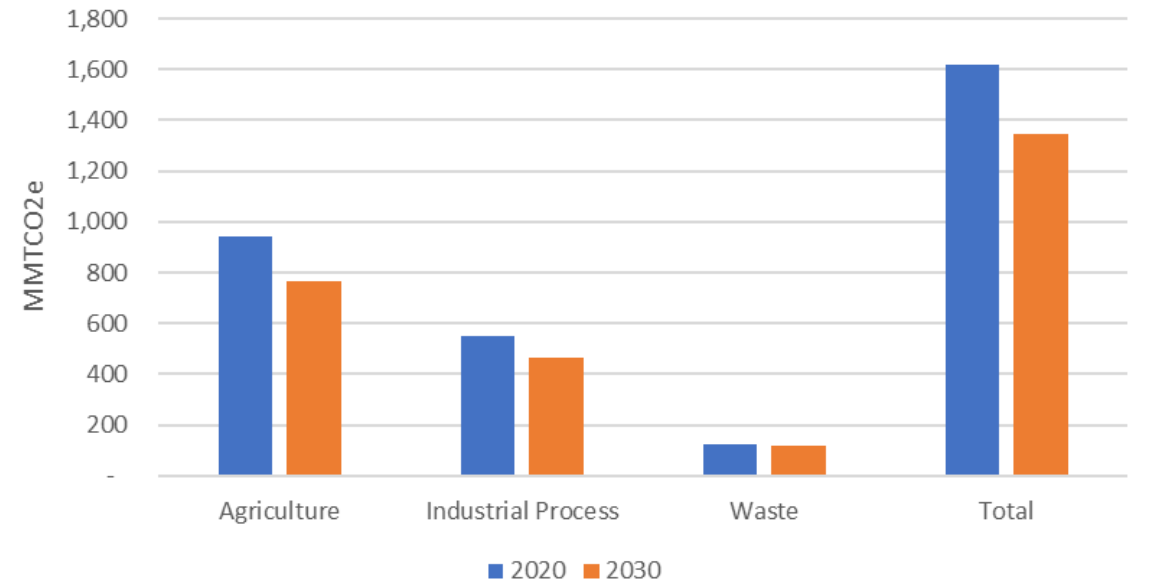
Sector Modeling Non-Energy

Non-Energy Sector – CAP Mitigation Scenario

100-Year GWP: Direct (At Point of Emissions)
Scenario: Mitigation Pathway, All Fuels, All GHGs



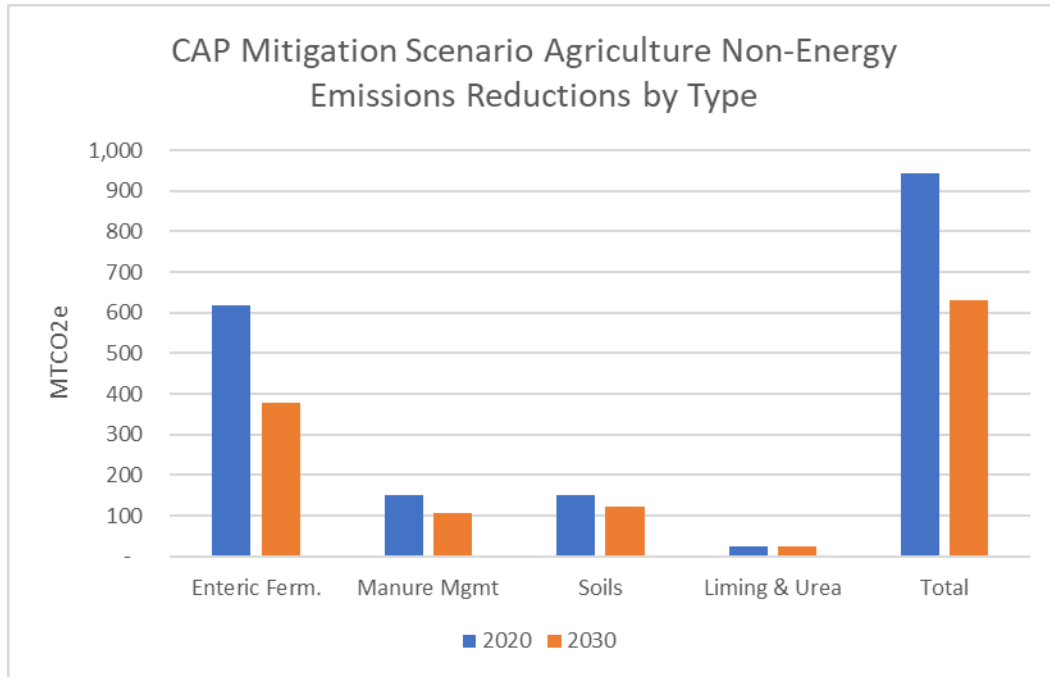
CAP Mitigation Scenario: Emissions Reductions from Non-Energy by Sub-Sector



Emissions reductions from 2020 to 2030 17%, and by 2050 52%.

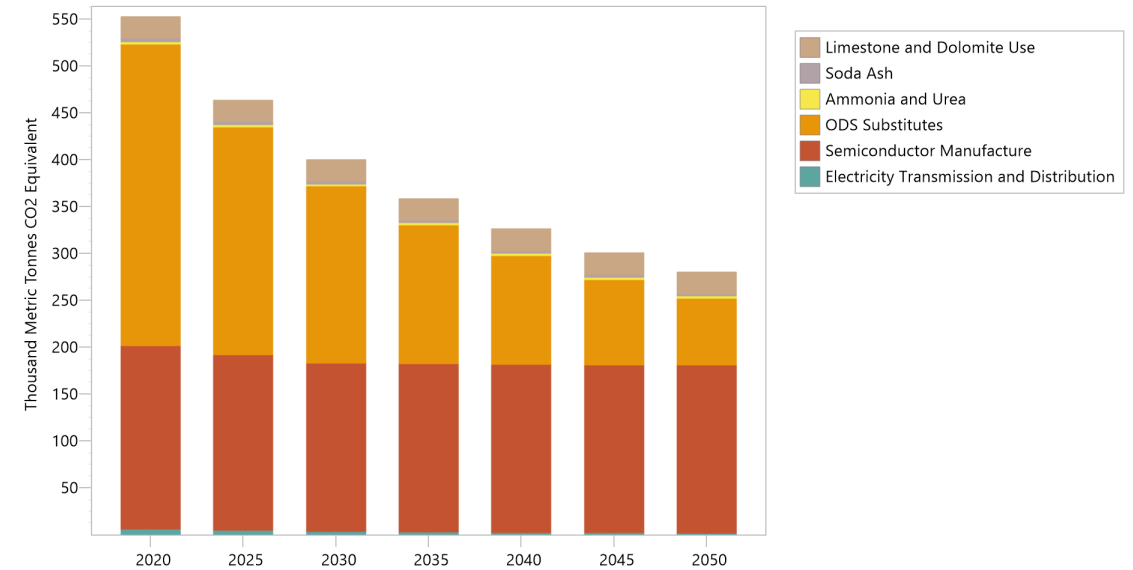
~2/3rds from Agriculture, 1/3rd Industrial Processes

CAP Mitigation Non-Energy Emissions Reductions by Sub-sector



Agriculture, 70%+ from enteric fermentation
 ~15% from manure management, and
 ~10% from soils

100-Year GWP: Direct (At Point of Emissions)
 Scenario: Mitigation Pathway, All Fuels, All GHGs

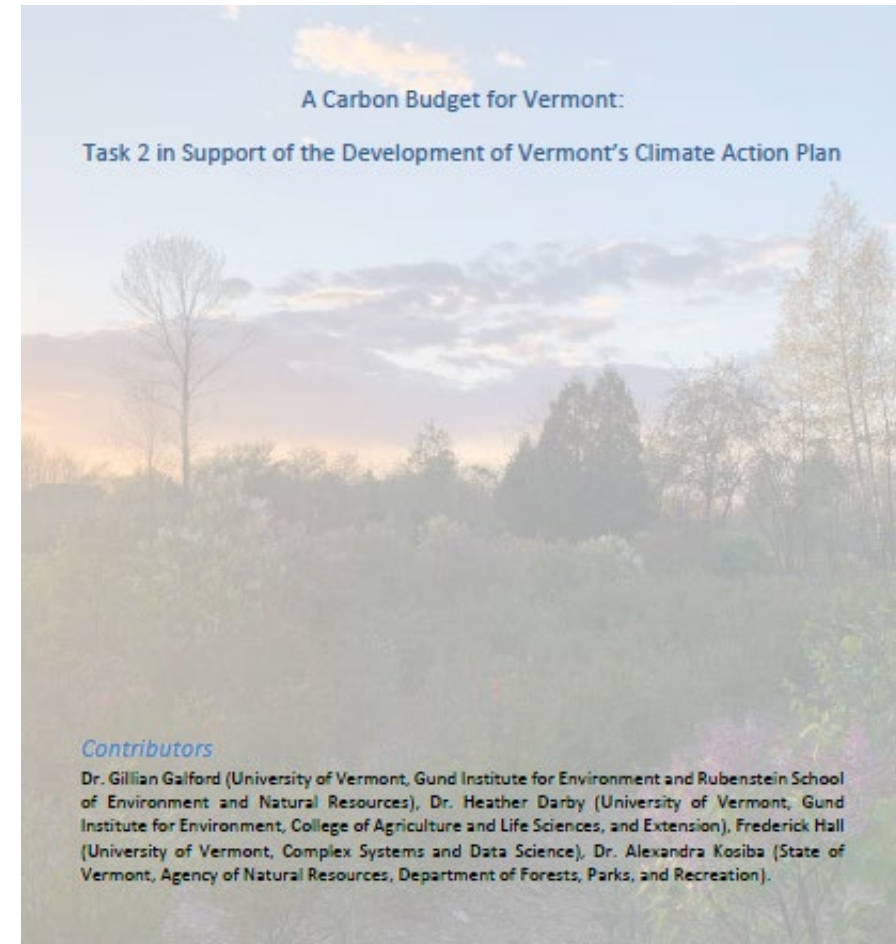



Industrial Process – Almost all reductions are ODS substitutes

Non-Energy Pathway Key Policies, Strategies & Actions

CAP Mitigation Pathway reflects new findings from the Carbon Budget Report. Analyses support the following for Pathways:

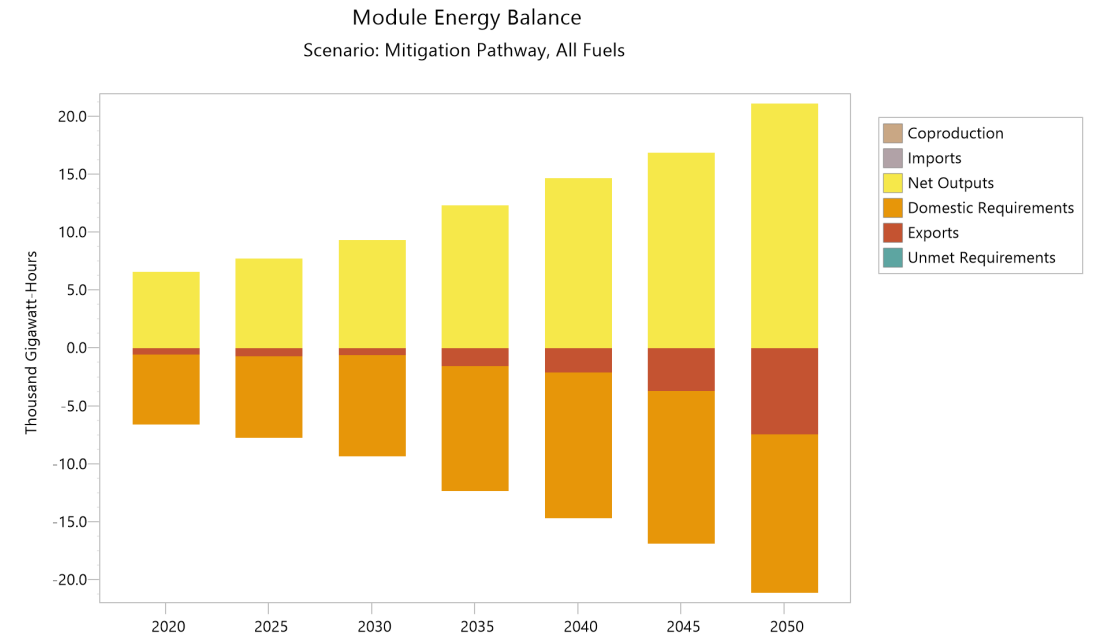
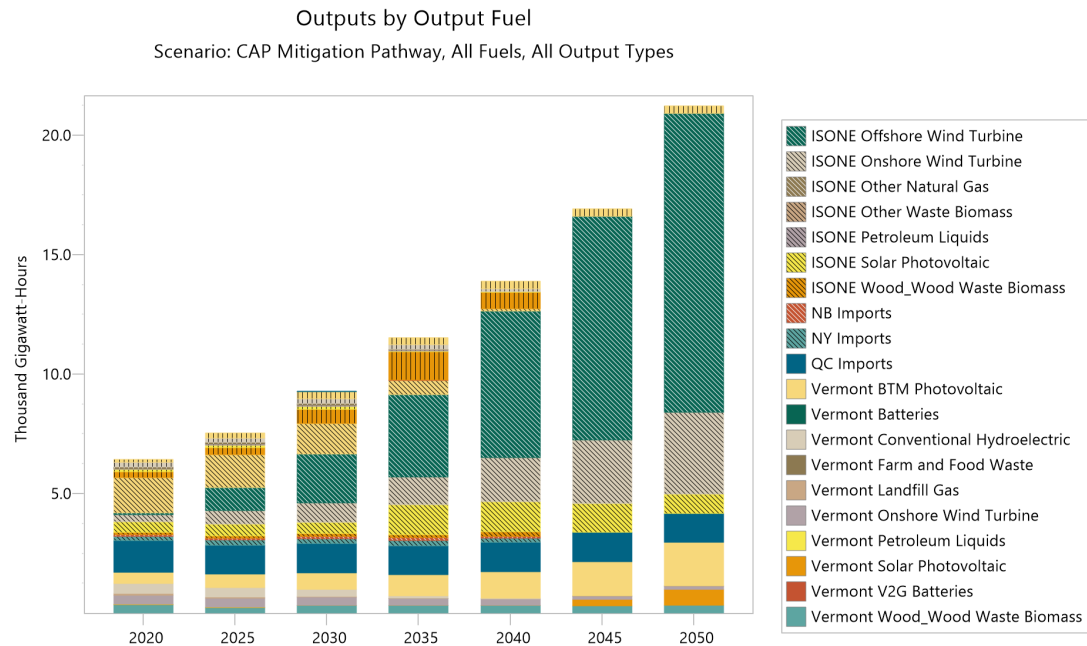
- Practices to reduce enteric fermentation emissions,
- Manure management initiative,
- Practices to increase soil carbon sequestration,
- ODS substitutes including refrigerant management,
- Target reductions for semi-conductor manufacturing





Sector Modeling Electricity

Electricity Sector – CAP Mitigation Scenario



Emissions from Electric Grid decline as gas, remaining coal and solid waste phase out by 2040.

Growth in Generation and capacity. Generation 6,600 GWh in 2020 → 9,300 GWh by 2030

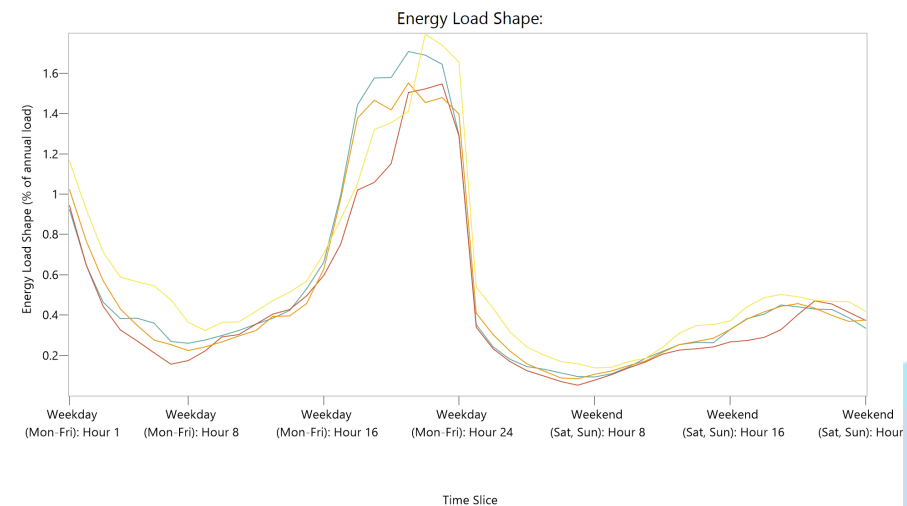
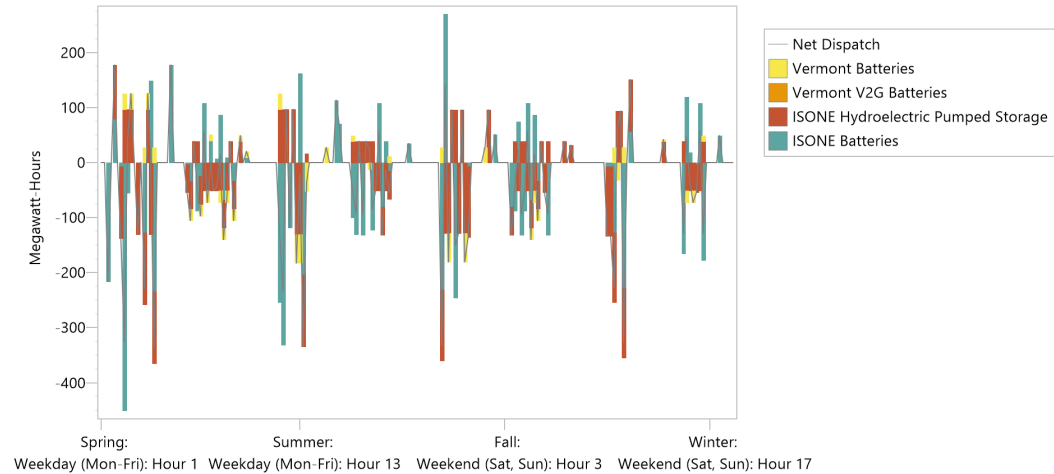
and 21,200 GWh by 2050. Installed capacity 2.8 GW in 2020 to 4.1 GW in 2030 and 12.2 GW by 2050.

Electricity Pathway Key Policies, Strategies & Actions

CAP Mitigation Pathway reflects and provides analytic support for:

- Expansion of renewable energy standard to 100% after 2032,
- Investigation of demand response, flexible load management, and storage to address curtailment
- Potential for additional strategic electrification in industry
- Consideration of Local renewables focus

Energy Generation
Scenario: CAP Mitigation Pathway, 2030

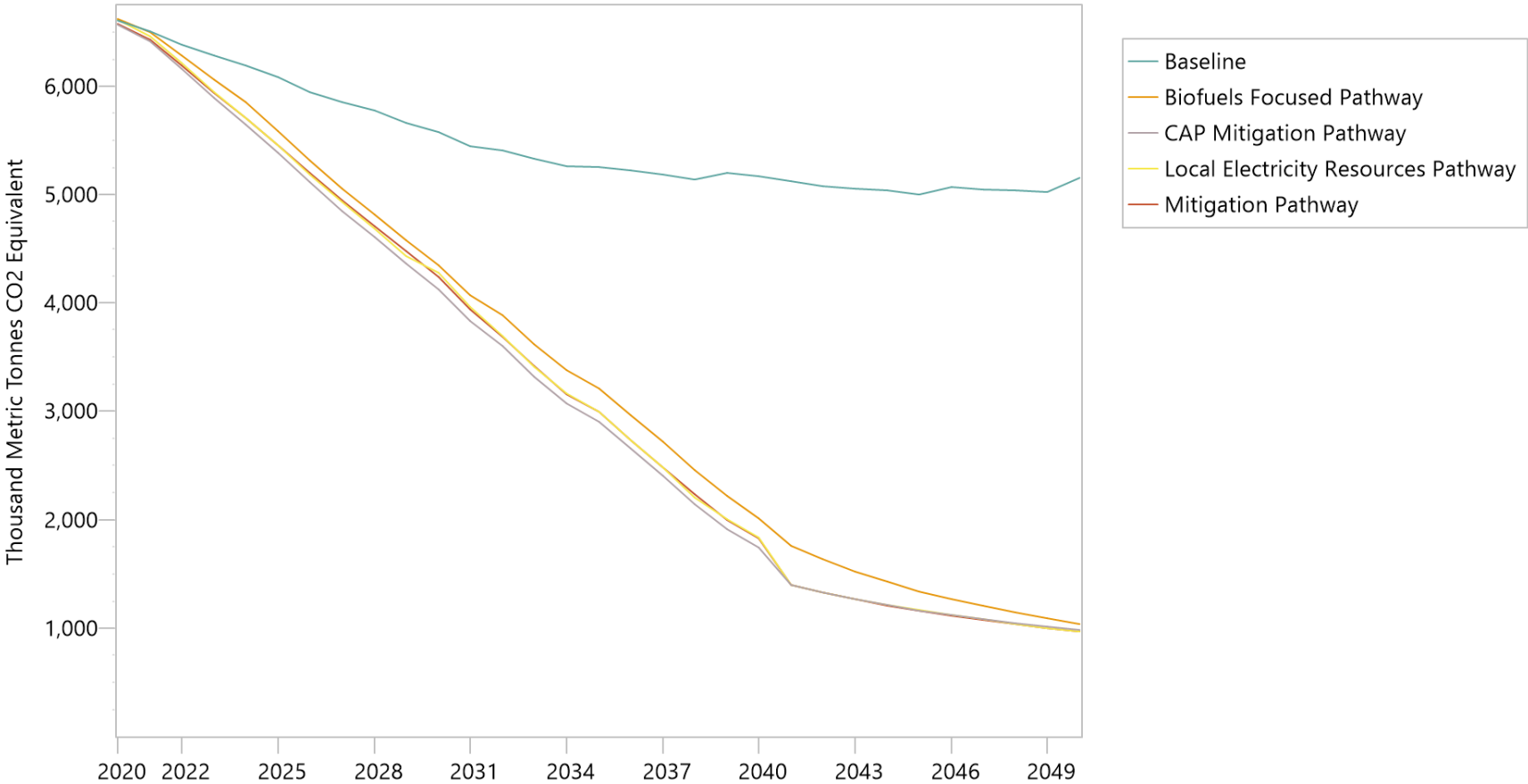




Cross Cutting Results

All Pathways Reflect Deep Multi-Sectoral Action

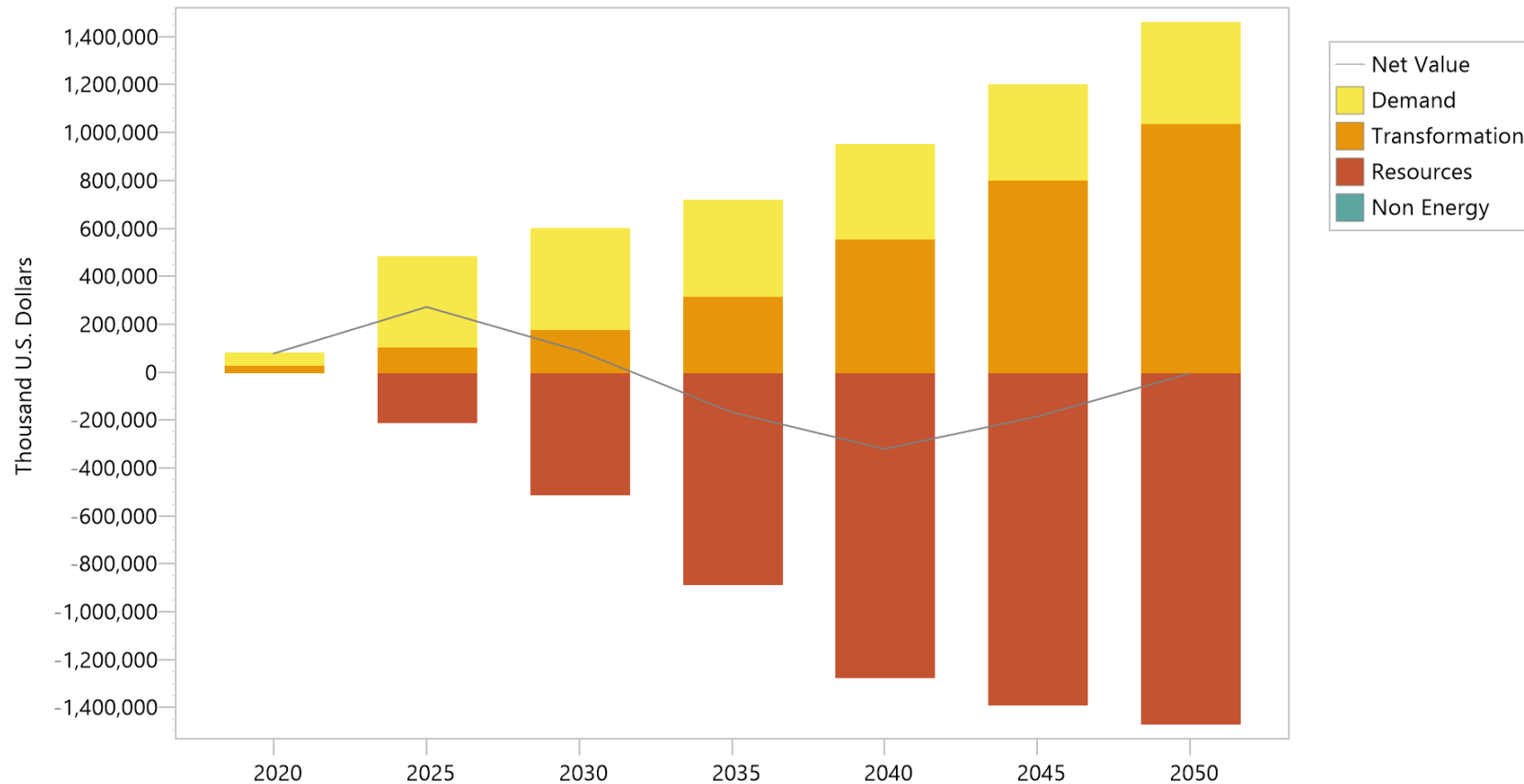
100-Year GWP: Direct (Demand) plus Indirect (Transformation) Emissions Allocated to Demands
All Fuels, All GHGs, All Urban Rurals, All Housing Structures



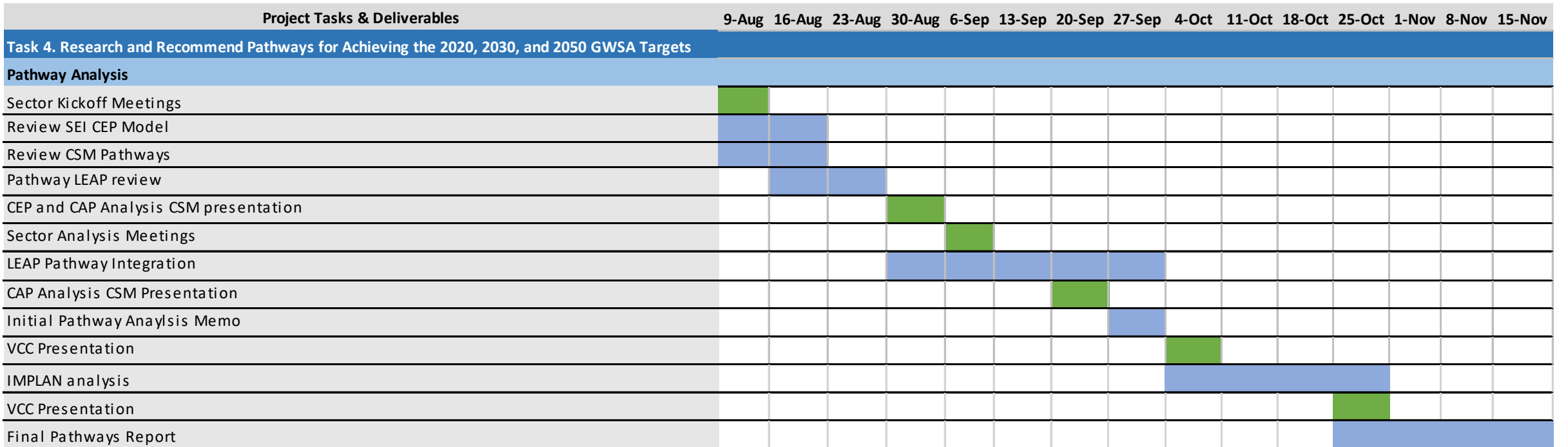
Economic: Early Demand Investments, Later Transformation

Social Costs

Scenario: CAP Mitigation Pathway Differences vs. Baseline, All Cost Categories, All Urban Rurals



Timeline





Questions and Discussion



Thank You!