

Its good to be back at NIES for the
28th meeting of the AIM team...

... if only virtually.



United States Emissions Pathways to 2050 Net Zero

Jae Edmonds

13 September 2022

Asia Integrated Modeling Keynote Address

United States National Climate Policy

- The United States has committed to reduce greenhouse gas emissions by 50 to 52 percent in 2030.
- Exploring a pathway to 2050 Net Zero greenhouse gas emissions in 2050.



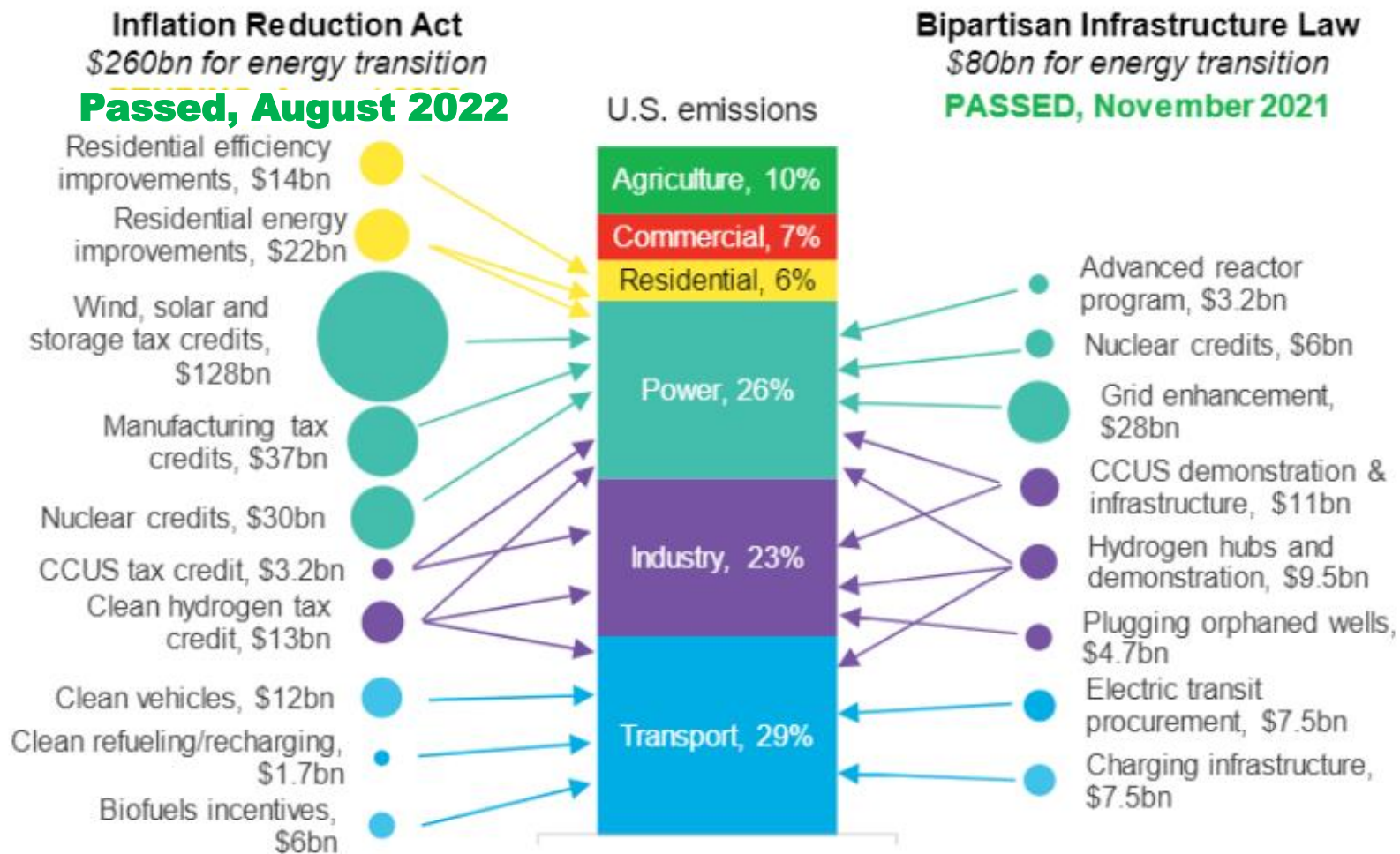
United States National Climate Policy

- The United States has committed to reduce greenhouse gas emissions by 50 to 52 percent in 2030.
- Exploring a pathway to 2050 Net Zero greenhouse gas emissions in 2050.
- Bipartisan Infrastructure Law (passed November 2021)
- Inflation Reduction Act (passed August 2022)

The Inflation Reduction Act was Passed in August of 2022



2022-2031 Energy Transition Spending in the IRA and BIL



Source: EIA, EPA, Joint Committee on Taxation, BloombergNEF. Note: Chart only captures tax credits and incentives, not grant programs or loans. Bn is billion. CCUS is carbon capture, utilization and storage.

IRA and BIL Emissions Impact

**Roughly 40% reduction
relative to 2005**

Three analyses support this

- Rhodium Group
- Energy Innovation
- Princeton University

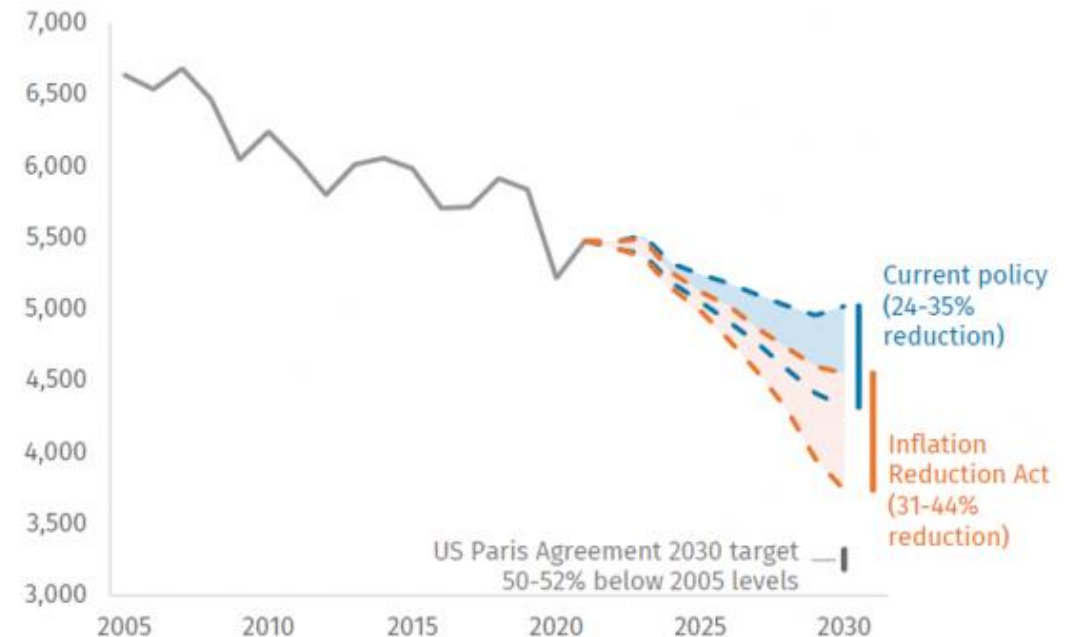
**These analyses are
preliminary.**

Rhodium Group

FIGURE 1

US greenhouse gas emissions

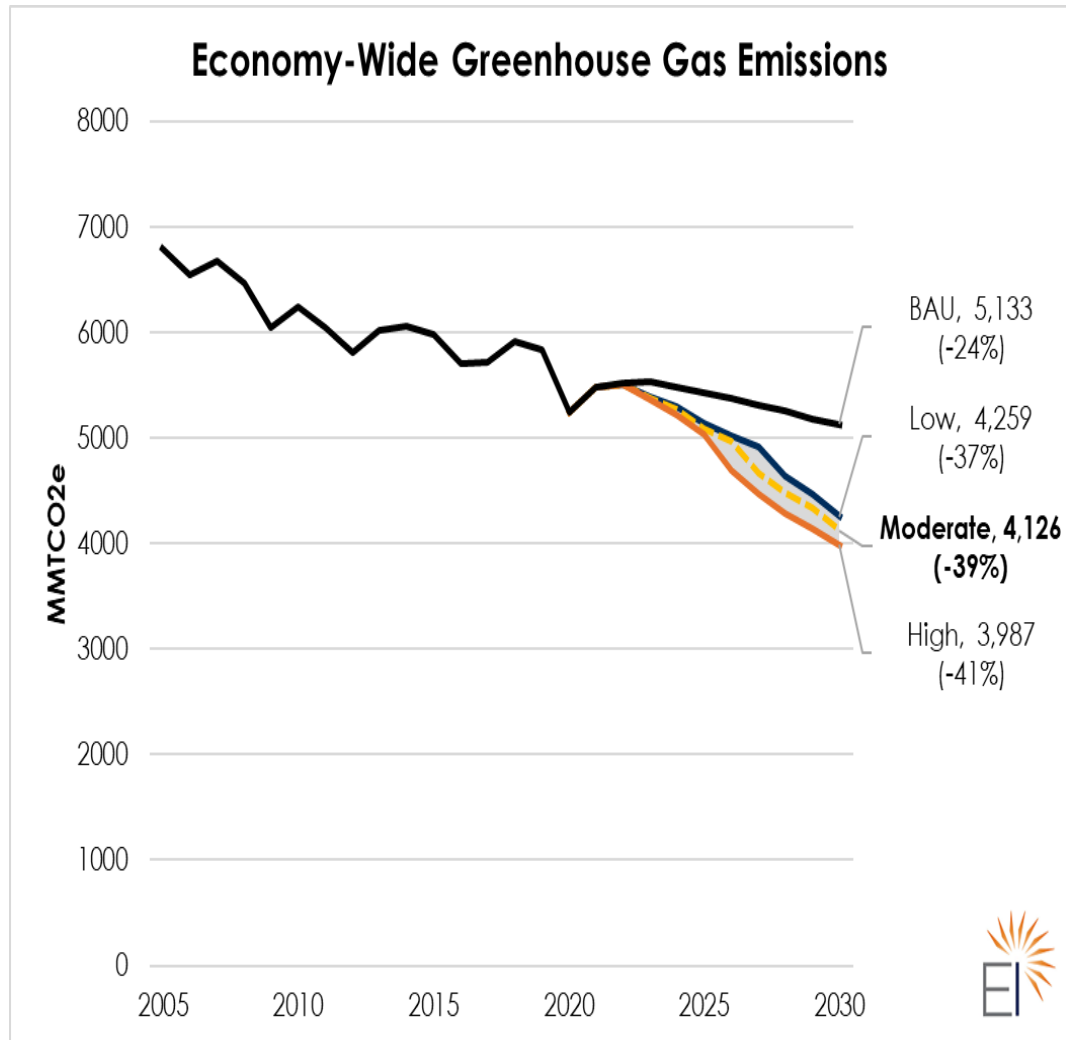
Net million metric tons (mmt) of CO₂-e



Source: Rhodium Group. The range reflects uncertainty around future fossil fuel prices, economic growth, and clean technology costs. It corresponds with high, central, and low emissions scenarios detailed in [Taking Stock 2022](#). Under the central scenario (not shown), the IRA accelerates emissions reductions to a 40% cut from 2005 levels.

IRA and BIL Emissions Impact

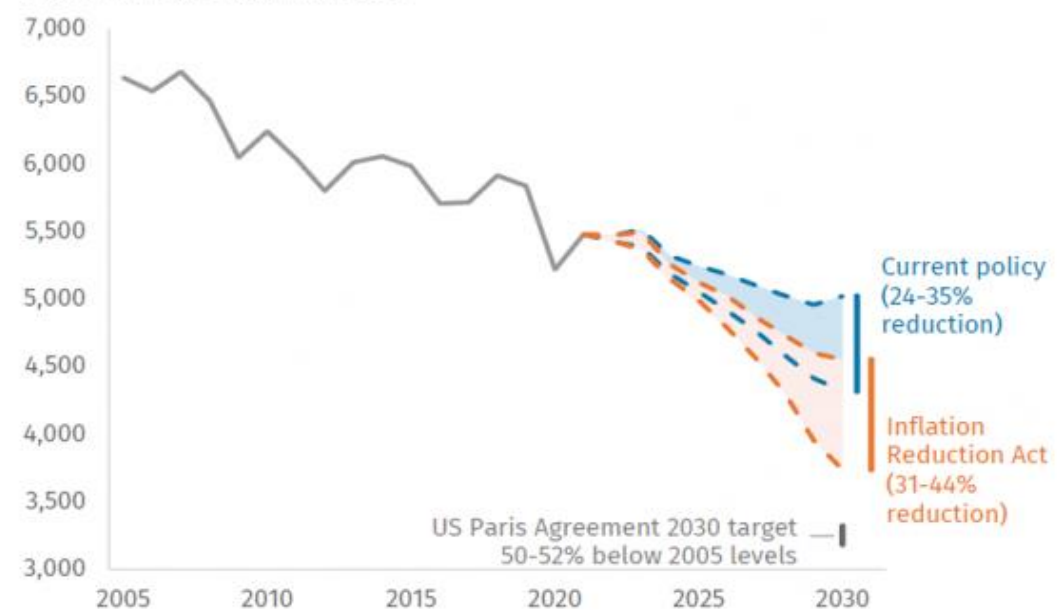
Energy Innovation



Rhodium Group

FIGURE 1

US greenhouse gas emissions
Net million metric tons (mmt) of CO₂-e

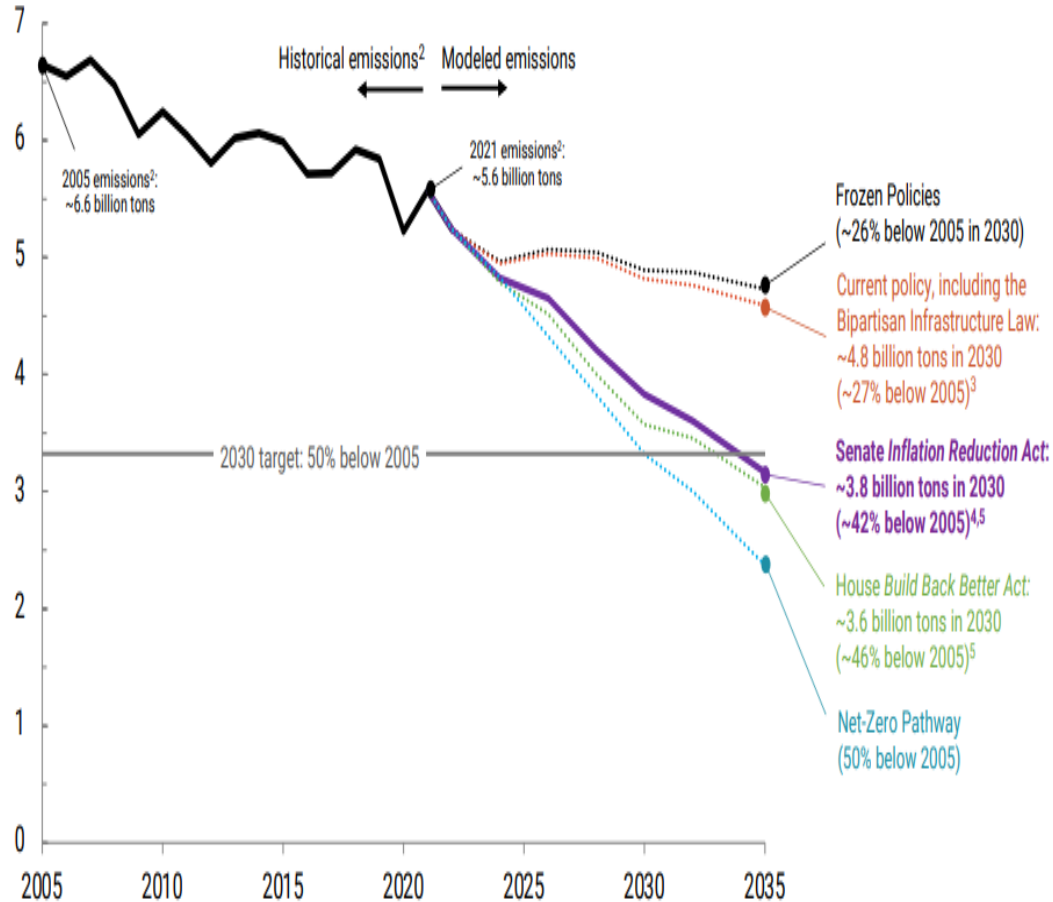


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IRA and BIL Emissions Impact

Princeton REPEAT Model

Historical and Modeled Net U.S. Greenhouse Gas Emissions (Including Land Carbon Sinks)
billion metric tons CO₂-equivalent (Gt CO₂-e)¹



Rhodium Group

FIGURE 1
US greenhouse gas emissions
Net million metric tons (mmt) of CO₂-e



Source: Rhodium Group. The range reflects uncertainty around future fossil fuel prices, economic growth, and clean technology costs. It corresponds with high, central, and low emissions scenarios detailed in [Taking Stock 2022](#). Under the central scenario (not shown), the IRA accelerates emissions reductions to a 40% cut from 2005 levels.

Analyses Are Preliminary

- The 40% reduction leaves the U.S. 10% short of its 2030 goal of 50-52% emissions reduction.
- The three U.S. studies use relatively simple models—at least compared to GCAM and AIM.
- The IRA and BIL are complex bills and need sophisticated models to adequately assess them.
 - E.g., 45Q is a complex subsidy provision of the tax code, not included in simple models.
- GCAM team is doing that now.

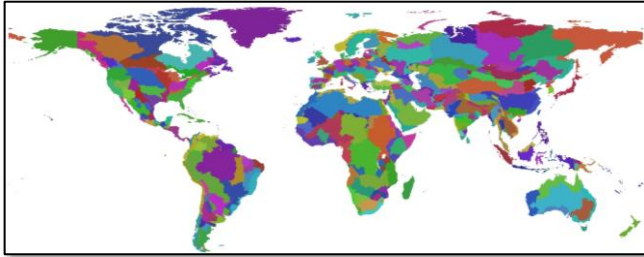
The GCAM Pathway to 2050 Net Zero

The Global Change Analysis Model (GCAM)

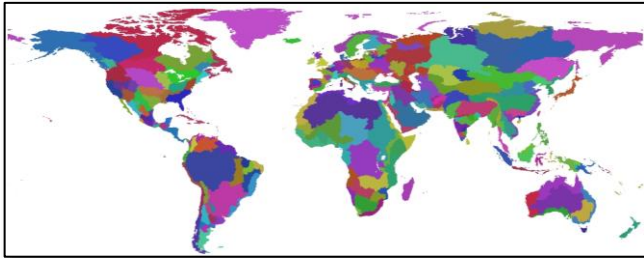
32 Energy-Economy Regions



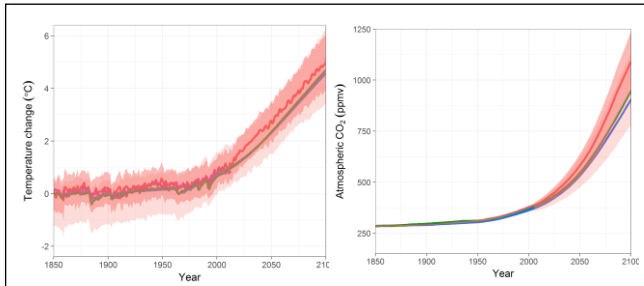
384 Land Regions



235 Water Basins

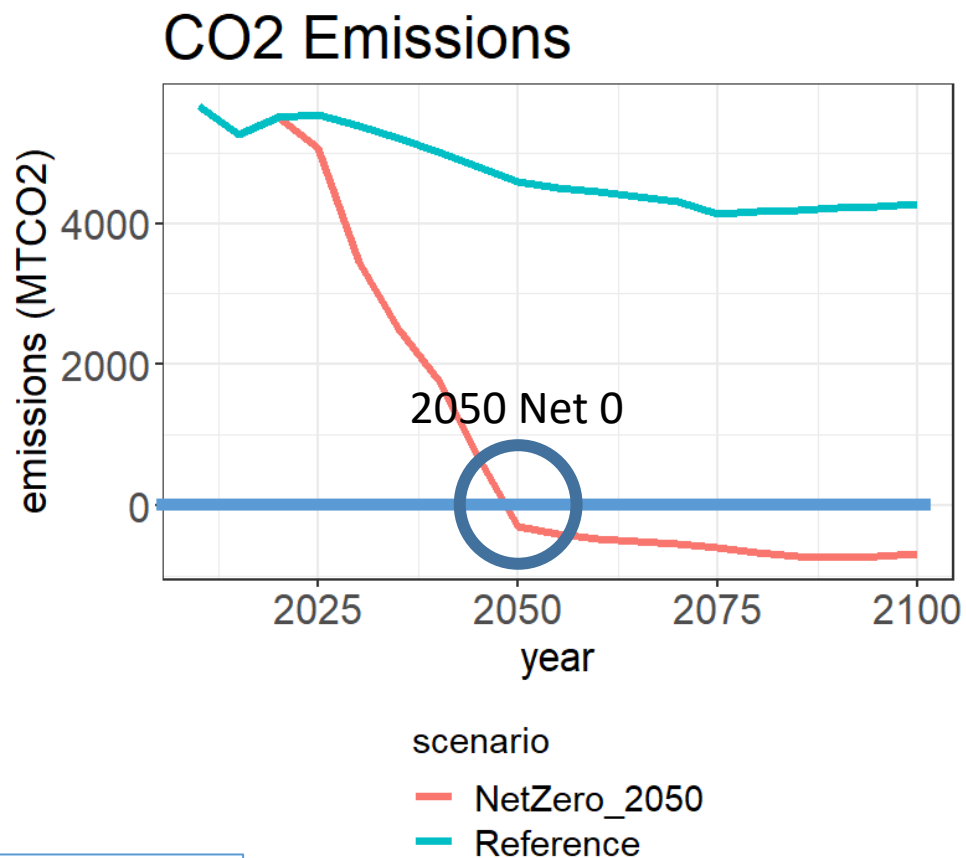


Reduced-Form Climate Model (Hector)



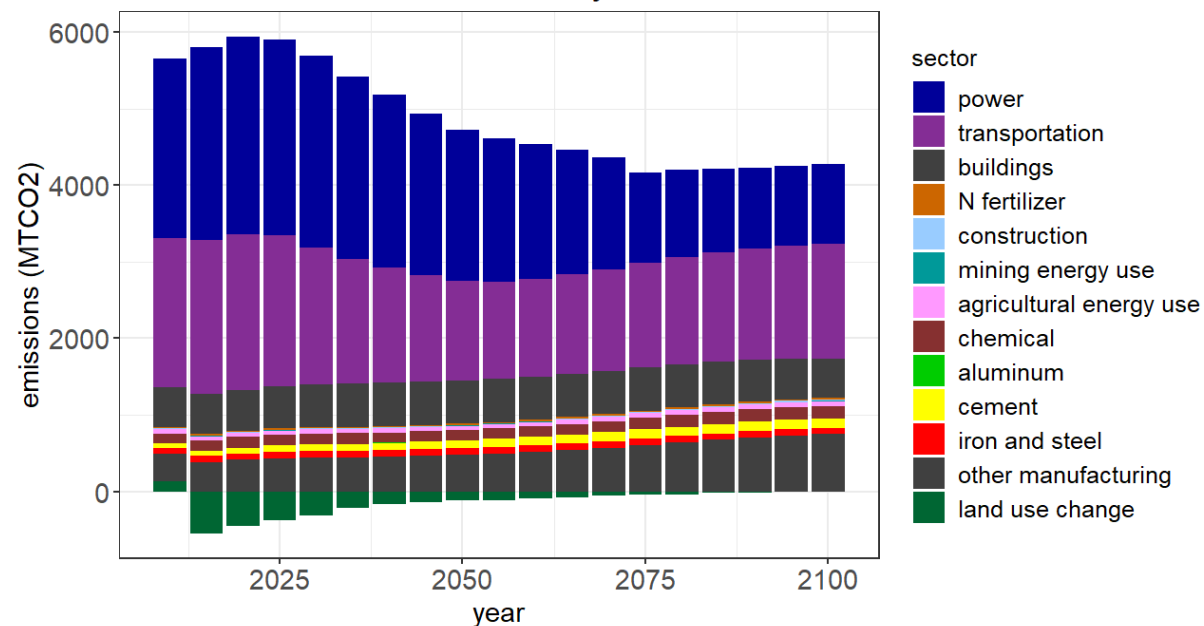
- Dynamic-recursive, economic market equilibrium model
- Inputs include assumptions about key drivers of future dynamics
 - Technology, national and international policies, socioeconomic development pathways, climate change
- Provides information about key outcomes
- **Five-year time steps** but can run on one-year time steps.
- **Community model** (<https://github.com/JGCRI/gcam-core/releases>)
- Regional versions are available or under construction for the U.S., India, China, Canada, and Latin America

Net-Zero Pathway

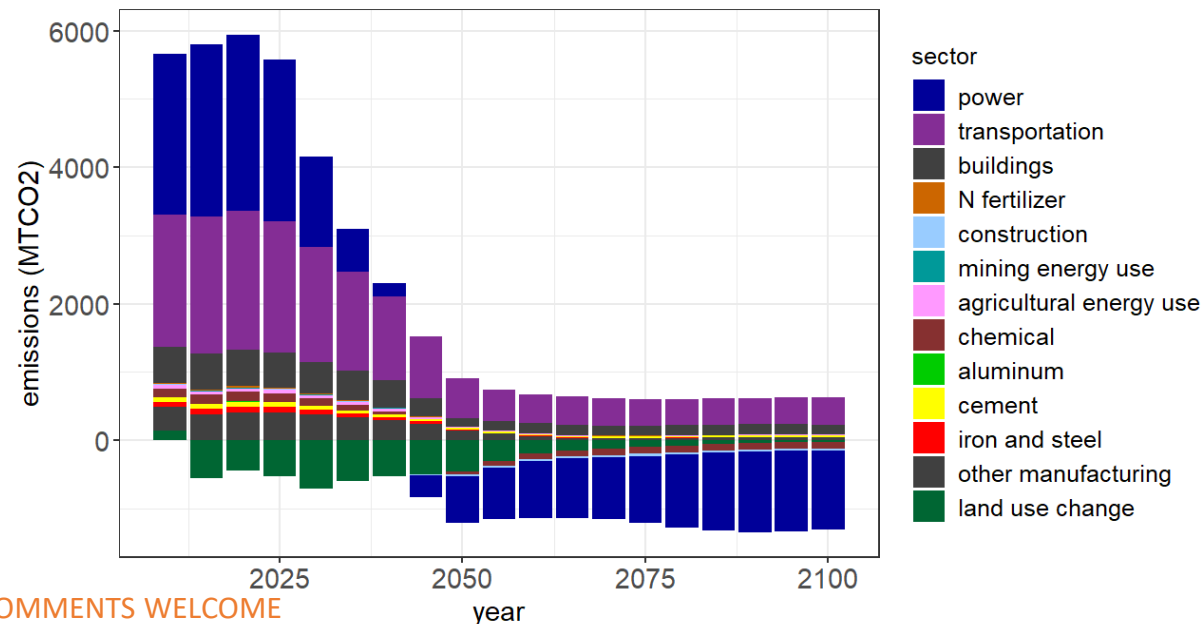


Note: Does not include retrofit CCS technology.

Reference.CO2 Emissions by Sector

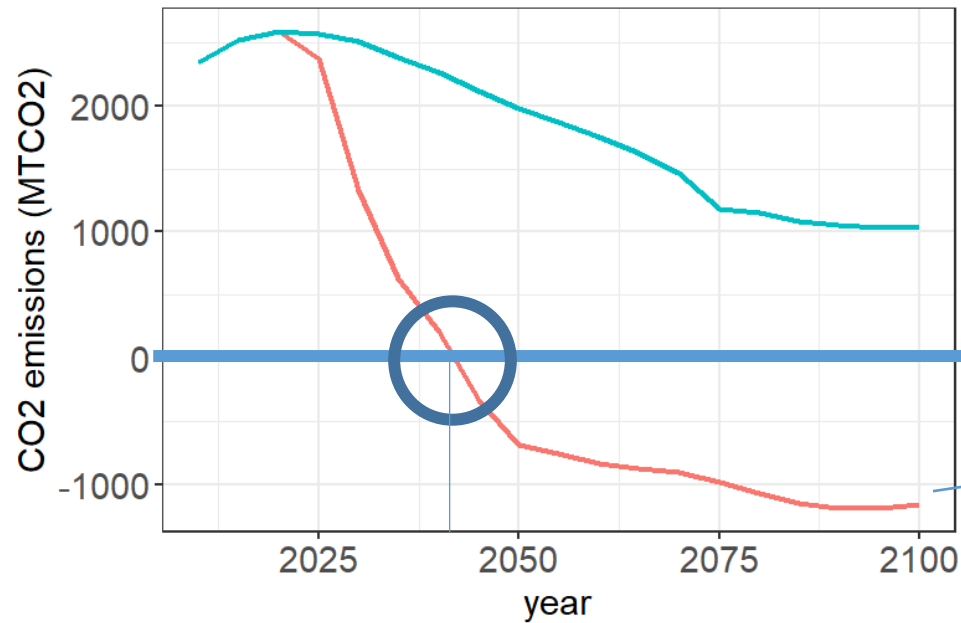


NetZero_2050.CO2 Emissions by Sector



Power Sector: emissions go negative 2040

U.S. Power Sector CO2 Emissions



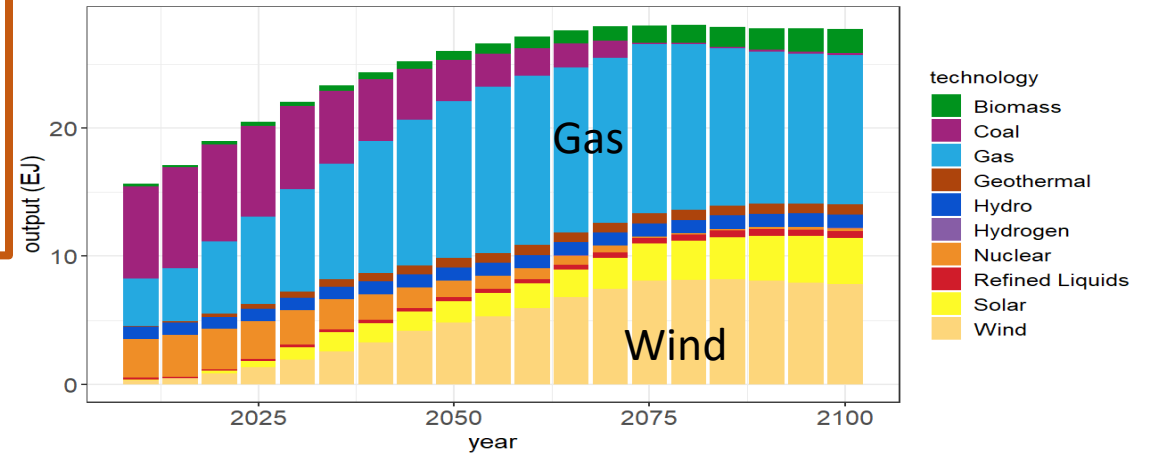
scenario

- NetZero_2050
- Reference

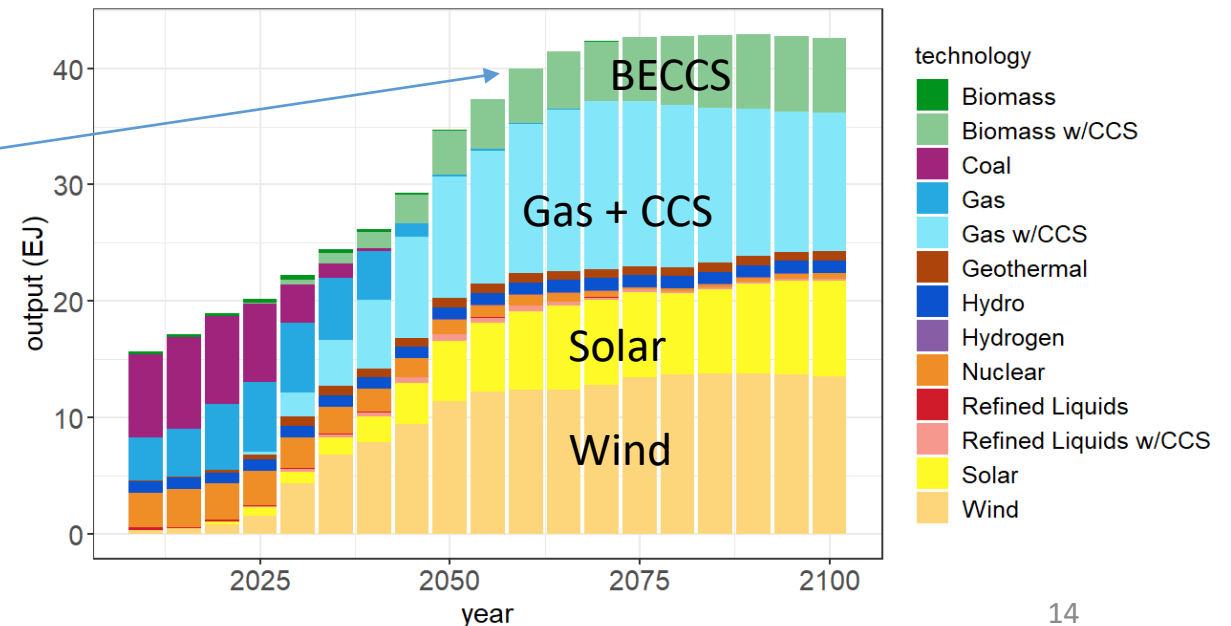
Note: Does not include retrofit CCS technology.

BECCS

Reference.U.S. Power Sector Fuel Mix

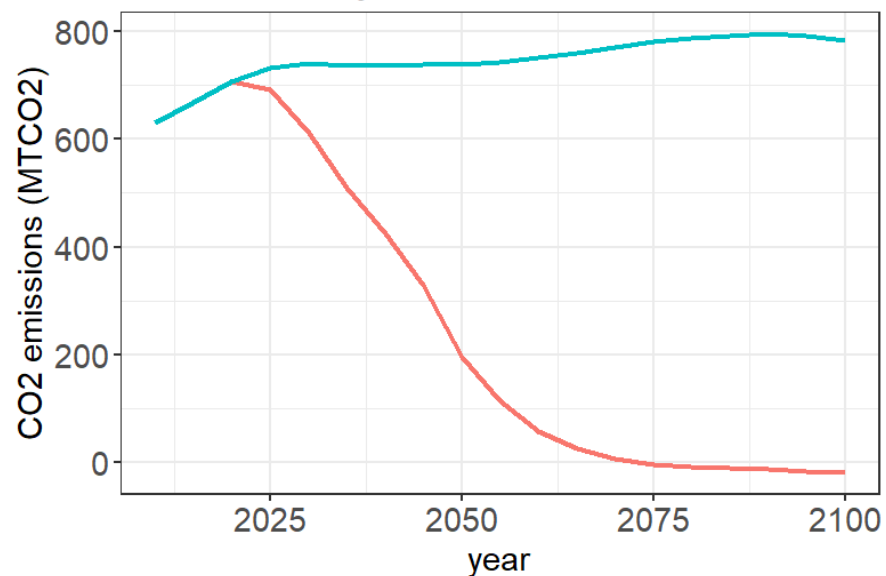


NetZero_2050.U.S. Power Sector Fuel Mix



Industry Electrifies

U.S. Industry Sector CO2 Emissions

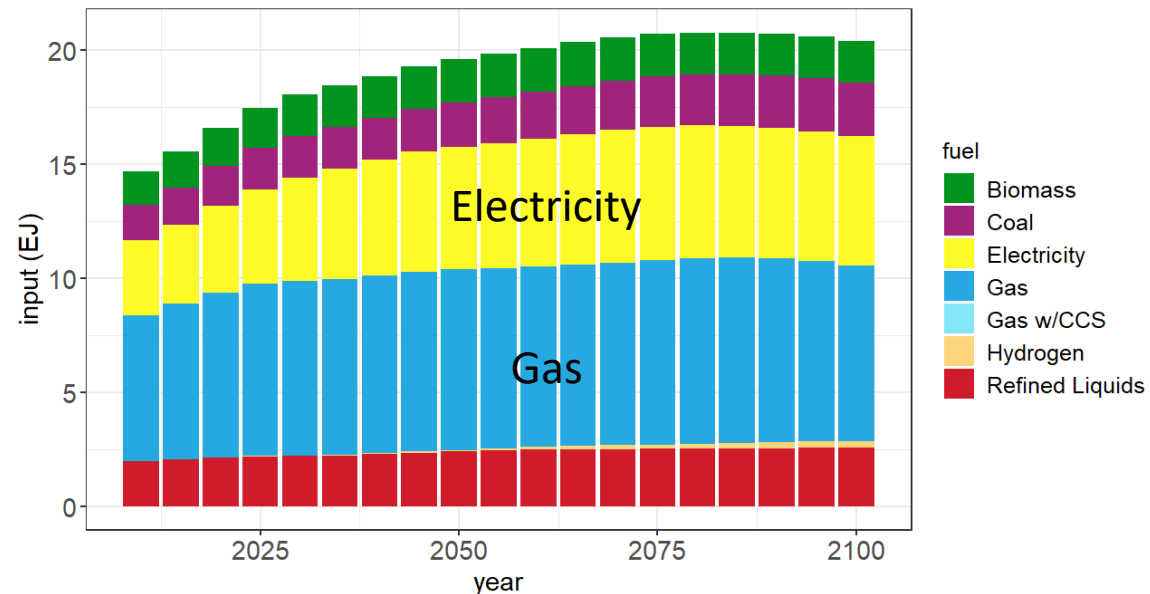


scenario

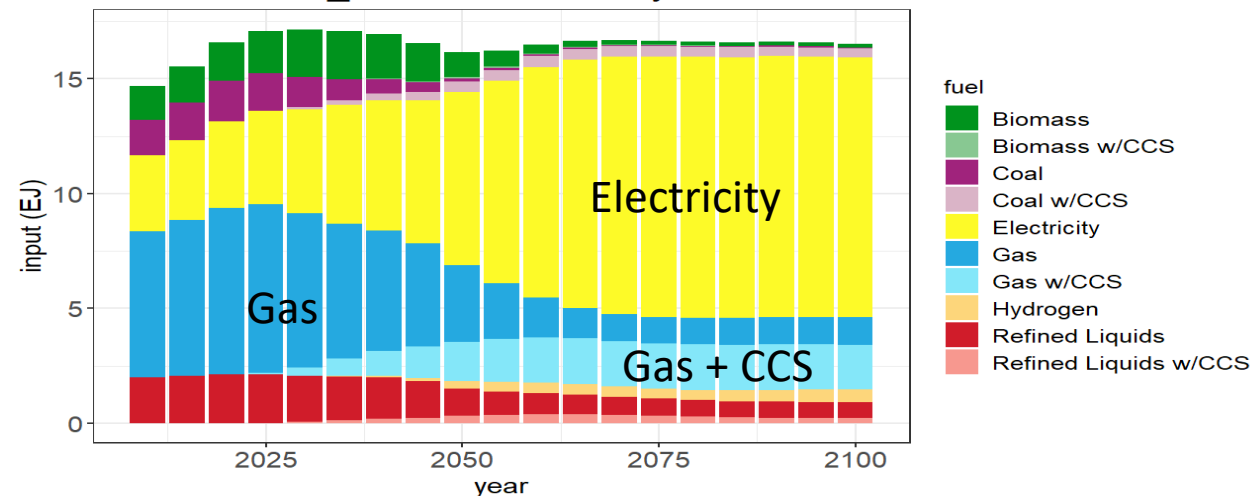
— NetZero_2050

— Reference

USA.Reference.U.S. Industry Sector Fuel Mix

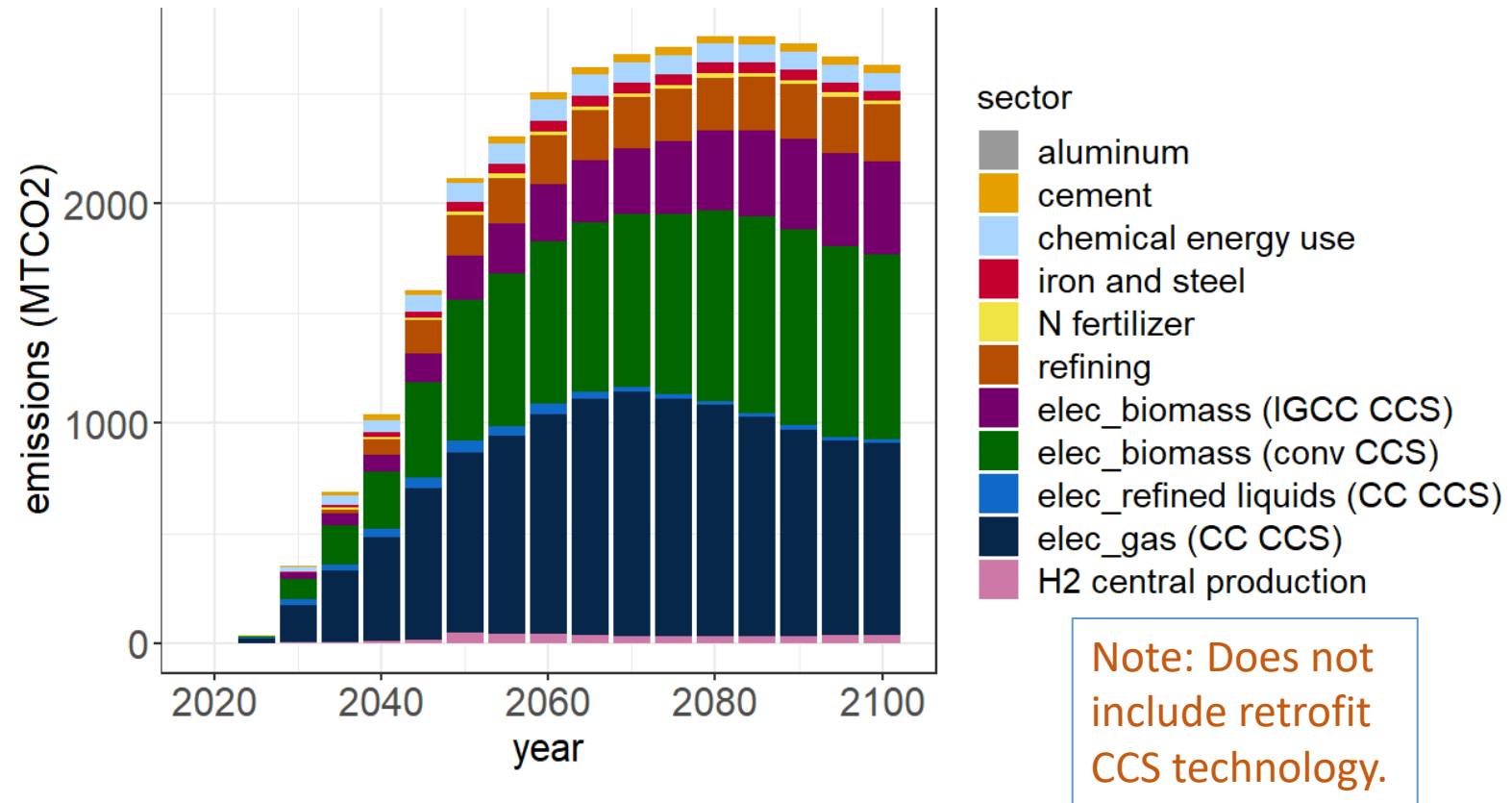
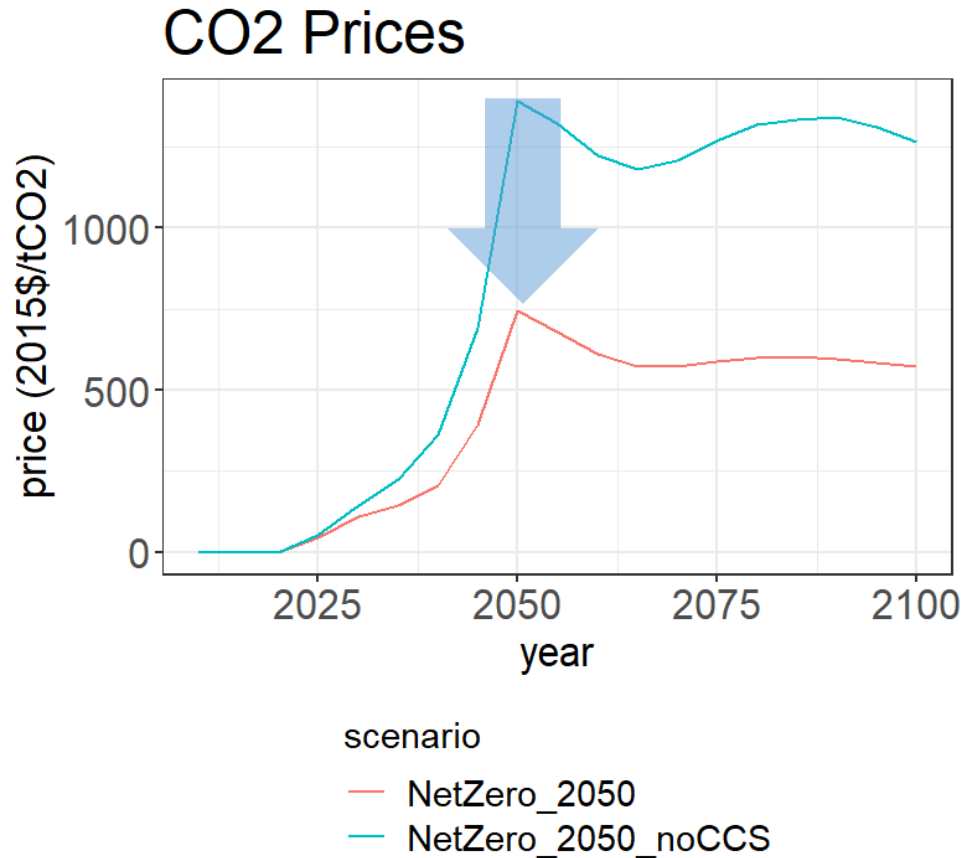


USA.NetZero_2050.U.S. Industry Sector Fuel Mix



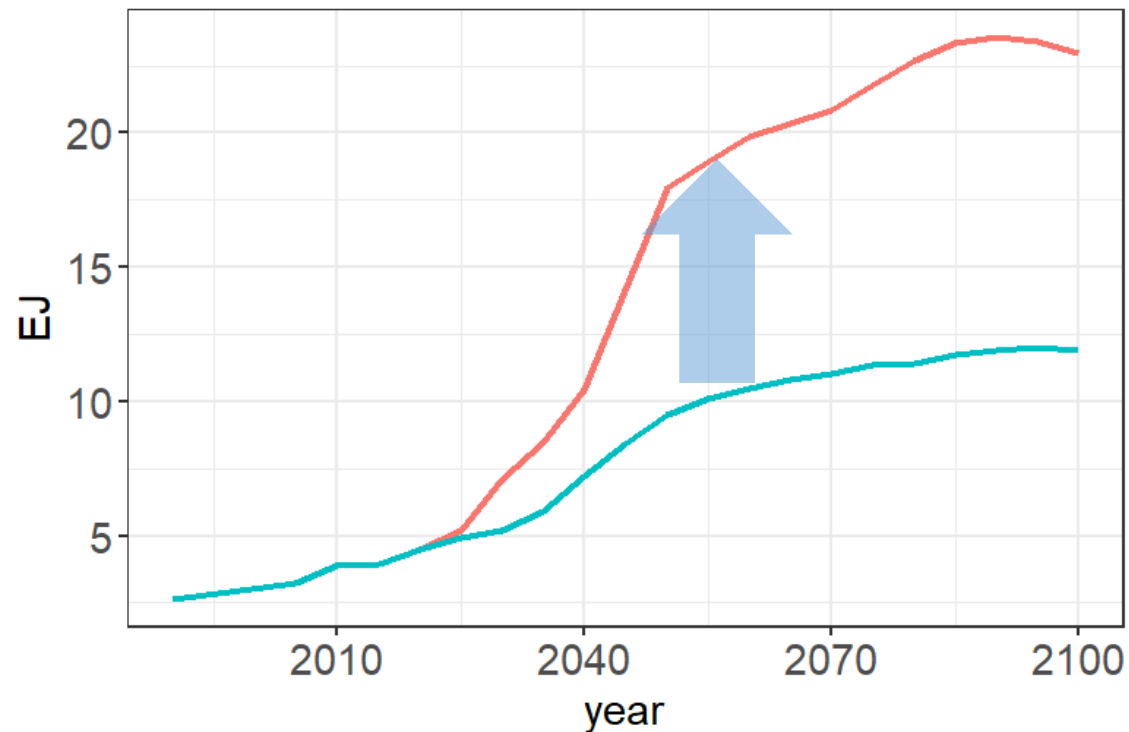
CCS: Carbon Prices and CO₂ Capture

CO₂ Capture by Sector



Bioenergy Use in Net Zero 2050

Biofuel Consumption

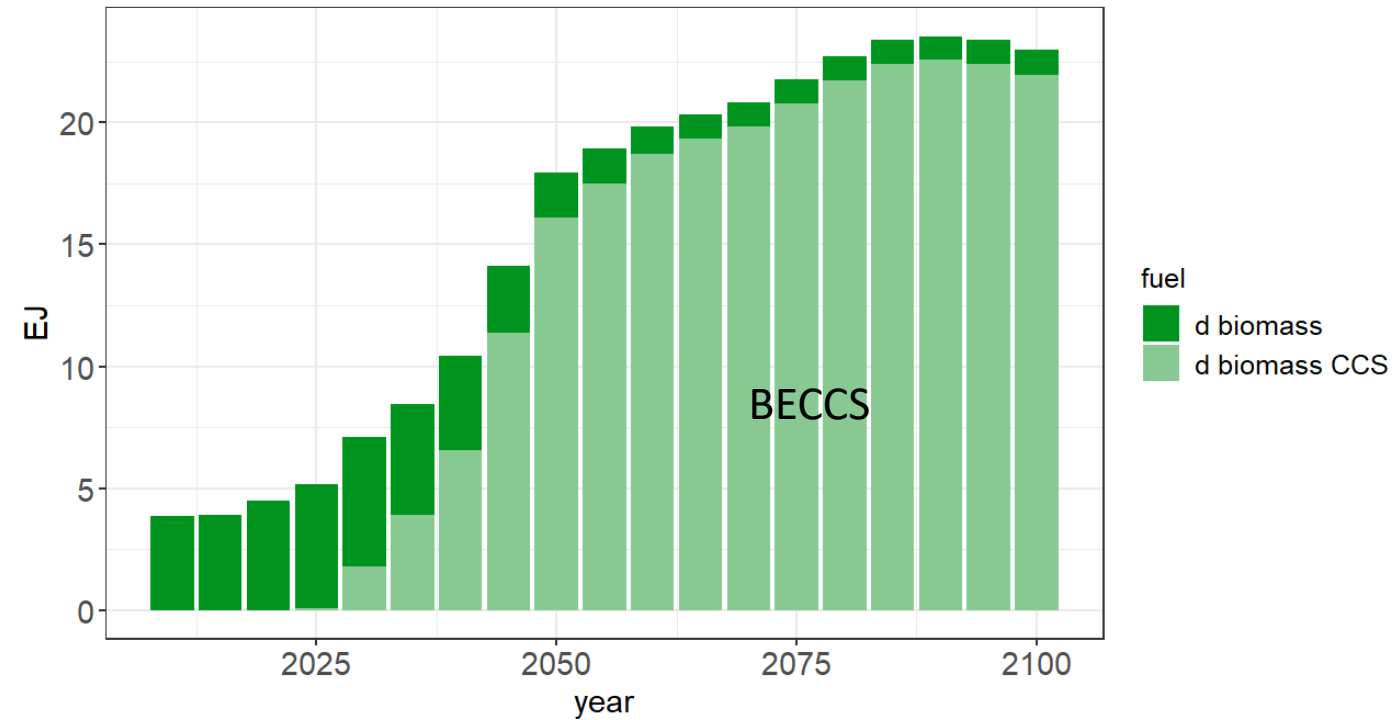


scenario

— NetZero_2050

— Reference

USA.NetZero_2050.Biofuel Consumption



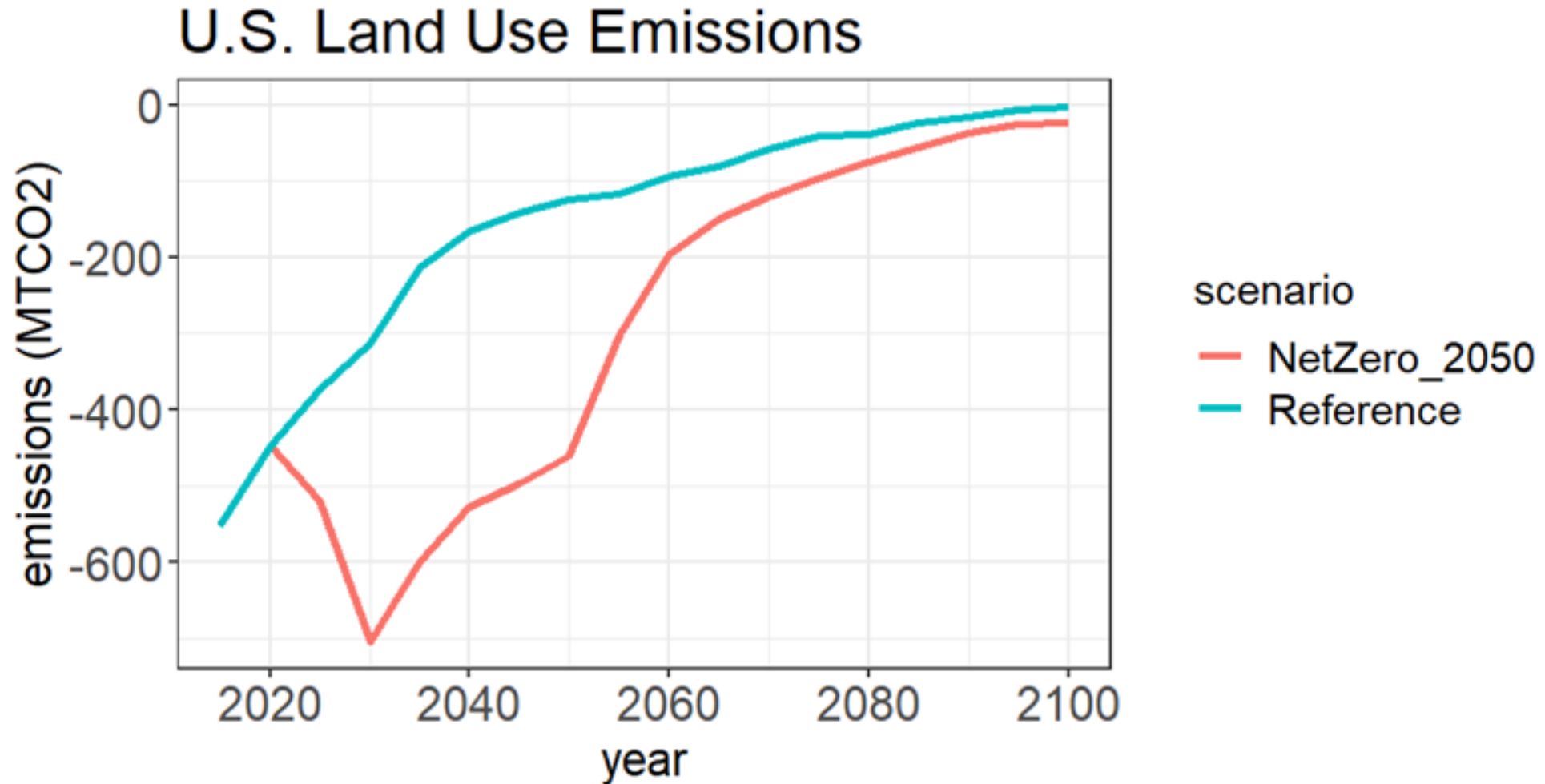
fuel

■ d biomass

■ d biomass CCS

BECCS

Land-use Change Emissions in NetZero





Together Again in 2023?...Let's hope

