REPEAT Rapid Energy Policy Evaluation and Analysis Toolkit

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PRINCETON UNIVERSITY

ZERO LAB

Zero-carbon Energy Systems Research and Optimization Laboratory

Preview: Final REPEAT Project Findings on the Emissions Impacts of the Inflation Reduction Act and Infrastructure Investment and Jobs Act

April 2023

Forward

With the close of the 117th Congress in January 2023, REPEAT Project has completed a revised, final analysis of the climate and energy system impacts of legislation passed during this landmark session. This includes detailed analysis of the combined impacts of H.R. 5376, the **Inflation Reduction Act of 2022** (IRA) and H.R. 3684, the **Infrastructure Investment and Jobs Act of 2021** (IIJA). This brief report previews REPEAT Project's final revised findings on the impact of these laws on the greenhouse gas emissions trajectory of the United States.

In this revised analysis, we have updated all assumptions to reflect the latest data available at year-end 2022[1] and improved the quality of source data and analysis on oil and gas sector methane emissions and abatement opportunities in agriculture and forestry sectors relative to our Preliminary Report on the Inflation Reduction Act released in August, 2022. This revised analysis now includes a range of three **Current Policies**[2] scenarios ('Conservative', 'Mid-range', and 'Optimistic') to better reflect uncertainty about the effectiveness of IRA provisions and the potential impacts of constraints on supply chains and other rate-limiting factors.[3] This report also presents two benchmark scenarios: a **Frozen Policies** scenario which only reflects policies enacted as of the start of the 117th Congress in January 2021; and a **Net-Zero Pathway** scenario, which reflects a cost-effective pathway to reduce U.S. greenhouse gas emissions to 50-52% below 2005 levels by 2030 and net-zero by 2050, consistent with President Biden's climate mitigation goals.

Stay tuned at repeatproject.org for our full report, which will detail a range of results including impact on greenhouse gas emissions, clean energy and electric vehicle deployment, fossil energy production and use, and more, along with estimated impacts on U.S. energy expenditures, capital investment, energy supply-related employment, air pollution, and public health.

1 – This includes an increase in near-term fossil fuel prices to impacts of the war in Ukraine and revised assumptions on electric vehicle uptake reflecting current market trends.

2 – Note that this report does *not* include the impact of light duty vehicle tailpipe emissions standards through MY2026 or medium/heavy clean trucks soot rule for MY2027+ finalized in late 2022. However, modeled results are very close to compliant with these rules in all cases. Both will be explicitly treated in subsequent REPEAT Project analysis later this year.

3 – See http://bit.ly/REPEAT-Policies for a complete list of policies in IRA and IIJA and assumptions and treatment of each policy under the three Current Policies scenarios.

About REPEAT Project

The **REPEAT Project** provides regular, timely and independent environmental and economic evaluation of federal energy and climate policies as they're proposed and enacted, offering a detailed look at the United States' evolving energy and climate policy environment and the country's progress on the road to net-zero greenhouse gas emissions.

Approach: employ geospatial planning and analysis tools coupled with detailed macro-energy system optimization models to **rapidly evaluate federal policy and regulatory proposals at politically-relevant spatial resolutions** (e.g., state, county, and finer resolutions). This is a refinement of methods used in the Princeton *Net-Zero America* study.

Goal: provide independent, timely, and credible information and analysis for broad educational purposes, including as a resource available publicly for stakeholders, decision-makers, and the media.

Funding: funding for the REPEAT Project was provided by a grant from the Hewlett Foundation.

Impact: throughout the 117th Congress, REPEAT Project played a central role in informing debate, media coverage, and public understanding of the impacts of proposed and enacted legislation. The project continues to provide regular analysis of pending and finalized federal regulations, updates on progress towards climate goals, and other analysis at **repeatproject.org**

The REPEAT Project Team

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Website development by **Hyperobjekt**.

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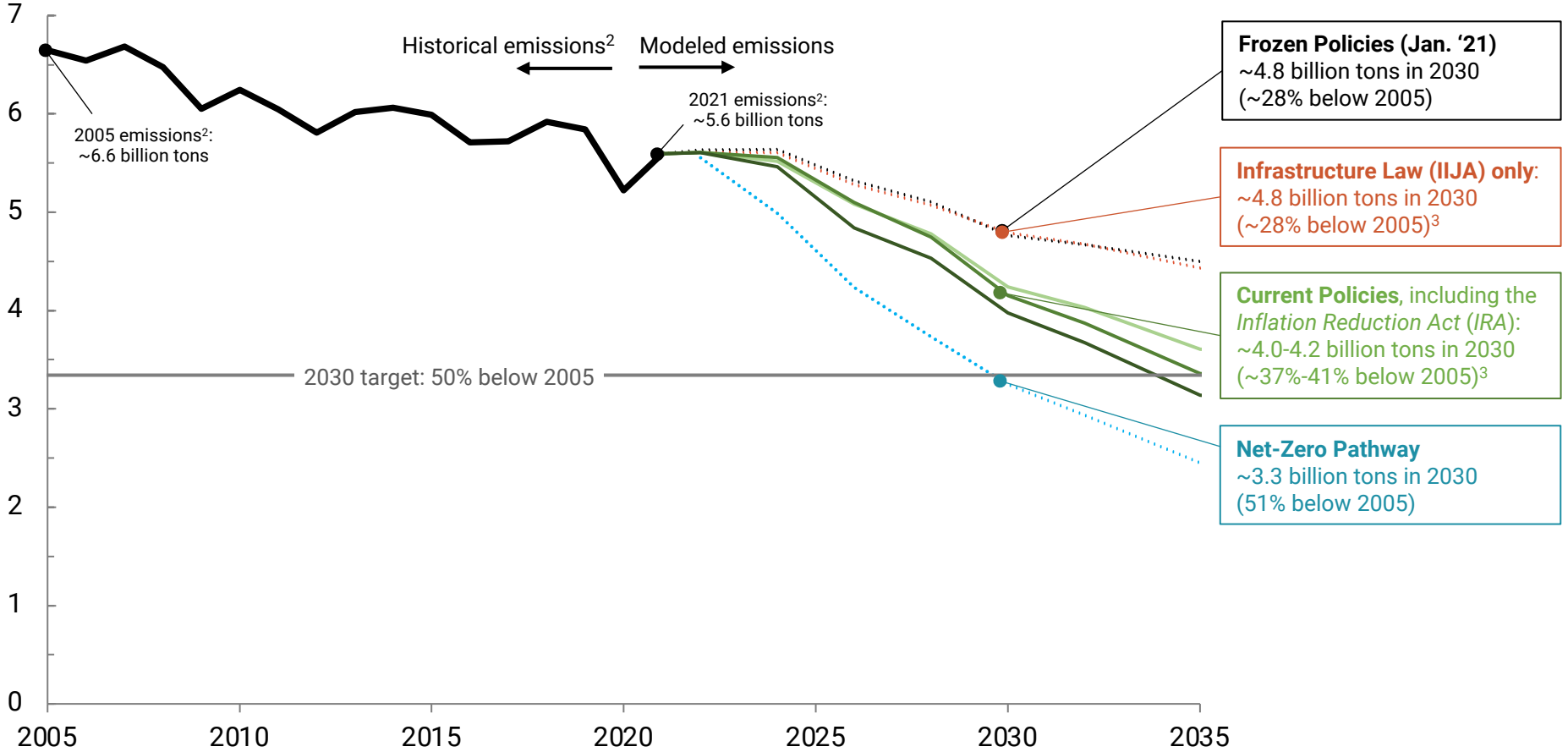
Historical and Modeled Net U.S. Greenhouse Gas Emissions (Including Land Carbon Sinks)

billion metric tons CO_2-equivalent (Gt CO_2-e)[1]



Frozen Policies (Jan. '21)
~4.8 billion tons in 2030
(~28% below 2005)

Infrastructure Law (IIJA) only:
~4.8 billion tons in 2030
(~28% below 2005)[3]

Current Policies, including the *Inflation Reduction Act* (*IRA*):
~4.0-4.2 billion tons in 2030
(~37%-41% below 2005)[3]

Net-Zero Pathway
~3.3 billion tons in 2030
(51% below 2005)

Legislation enacted by the 117th Congress could:

- **roughly double the pace of annual U.S. decarbonization** to ~4%/year.
- **cut annual emissions in 2030 by an additional ~0.5-0.8 billion metric tons**
- **get the U.S. to ~37-41% below 2005 historical GHG emissions** (vs national target of 50-52%)
- **reduce cumulative GHG emissions by about 3.4-5.6 billion tons over the next decade** (2023-2032).

1 - CO_2-equivalent emissions calculations use IPCC AR4 100 year global warming potential as per EPA Inventory of Greenhouse Gas Emissions and Sinks. **All values should be regarded as approximate given uncertainty in future outcomes.**

2 - Historical data from US EPA Inventory for 2005-2020; 2021 estimate from February 2023 draft EPA Inventory.

3 - Modeled emissions exclude any changes in passenger and freight miles traveled due to surface transportation, rail, and transit investments in IIJA. According to the Georgetown Climate Center, emissions impact of these changes depend heavily on state implementation of funding from IIJA, which could result in anywhere from -14 Mt/yr to +25 Mt/yr change in CO_2 emissions from transportation in 2030.

Modeled Net U.S. Greenhouse Gas Emissions (Including Land Carbon Sinks)

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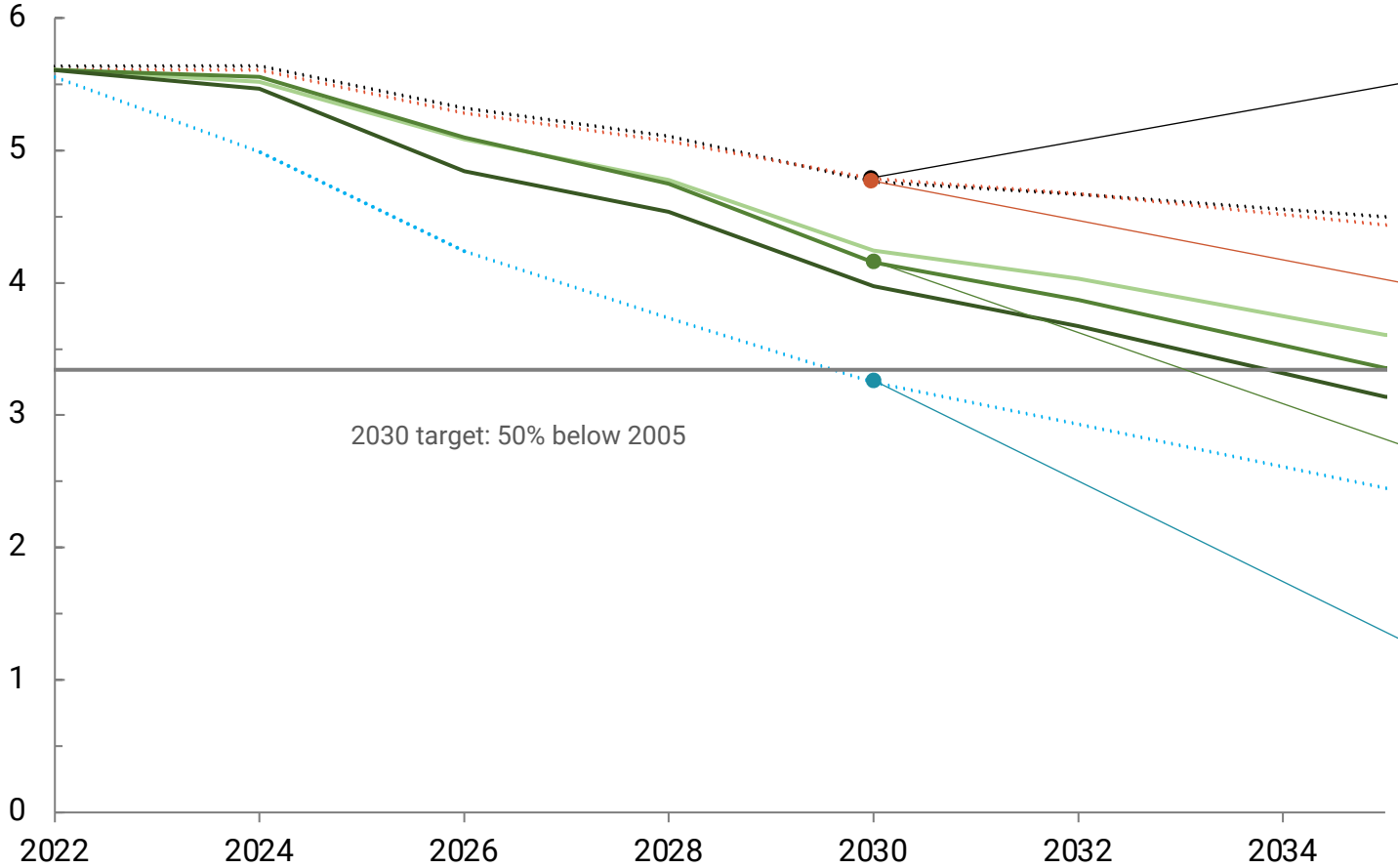

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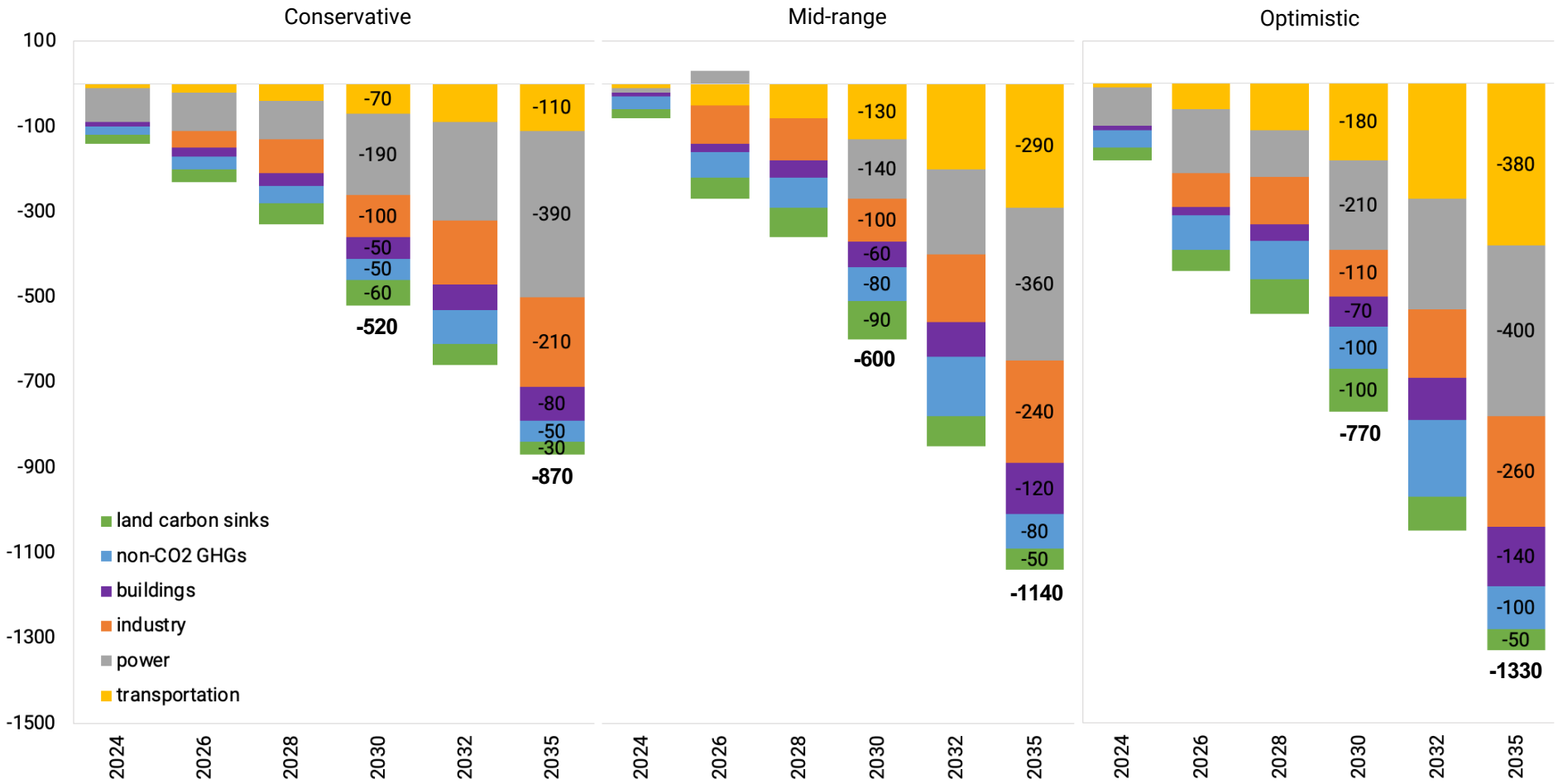
Difference in Sectoral Emissions vs Frozen Policies as of January 2021

million metric tons CO_2-equivalent (Mt CO_2-e)[1,2]



- Changes in **the transportation sector** (e.g. electrification) **and power sector** (e.g. renewable energy deployment) **are responsible for roughly half of all emissions reductions** across all Current Policies scenarios.
- Yet ***IRA* delivers emissions reductions across all major emitting sectors** of the economy including industry, buildings, and agricultural and forestry lands.

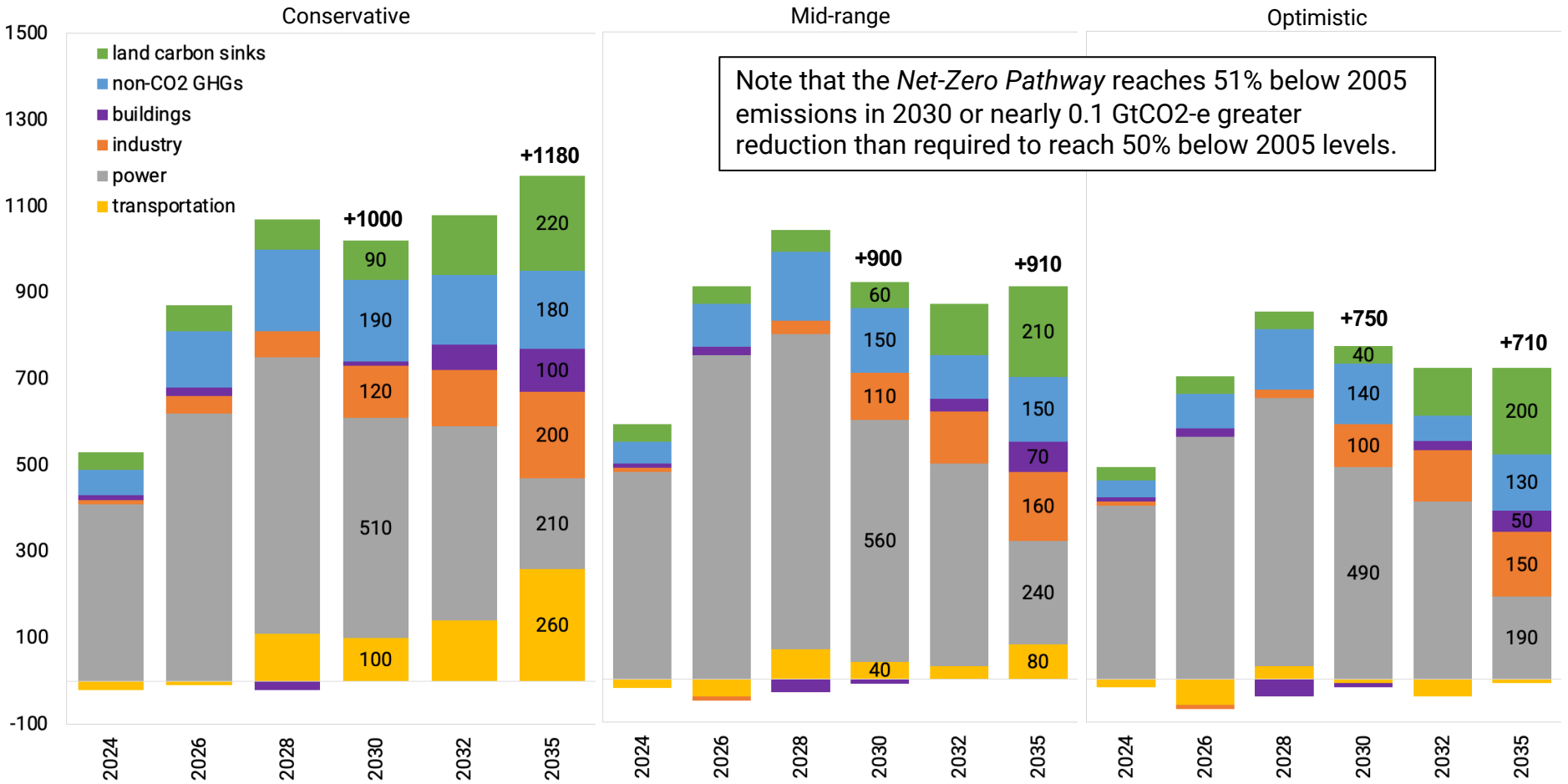
Notes:

1 - CO_2-equivalent emissions calculations use IPCC AR4 100 year global warming potential as per EPA Inventory of Greenhouse Gas Emissions and Sinks. All values rounded to nearest 10 M/yr. **All values should be regarded as approximate given uncertainty in future outcomes.**

2 - Modeled emissions exclude any changes in passenger and freight miles traveled due to surface transportation, rail, and transit investments in IIJA. According to the Georgetown Climate Center, emissions impact of these changes depend heavily on state implementation of funding from IIJA, which could result in anywhere from -14 Mt/yr to +25 Mt/yr change in CO_2 emissions from transportation in 2030.

Difference in Sectoral Emissions vs Net-Zero Pathway

million metric tons CO_2-equivalent (Mt CO_2-e)[1,2]



Note that the *Net-Zero Pathway* reaches 51% below 2005 emissions in 2030 or nearly 0.1 GtCO2-e greater reduction than required to reach 50% below 2005 levels.

Further emissions reductions are needed to close the gap with the *Net-Zero Pathway* and reach 2030 targets.

Major opportunities[3] include:

- ~0.2 Gt in the power sector by accelerating **coal plant retirements**.[4]
- ~0.1 Gt via improved **industrial process efficiency**.
- ~0.2-0.3 Gt via additional **abatement of non-CO2 GHGs** and **improved agricultural and forestry practices**.

Notes:

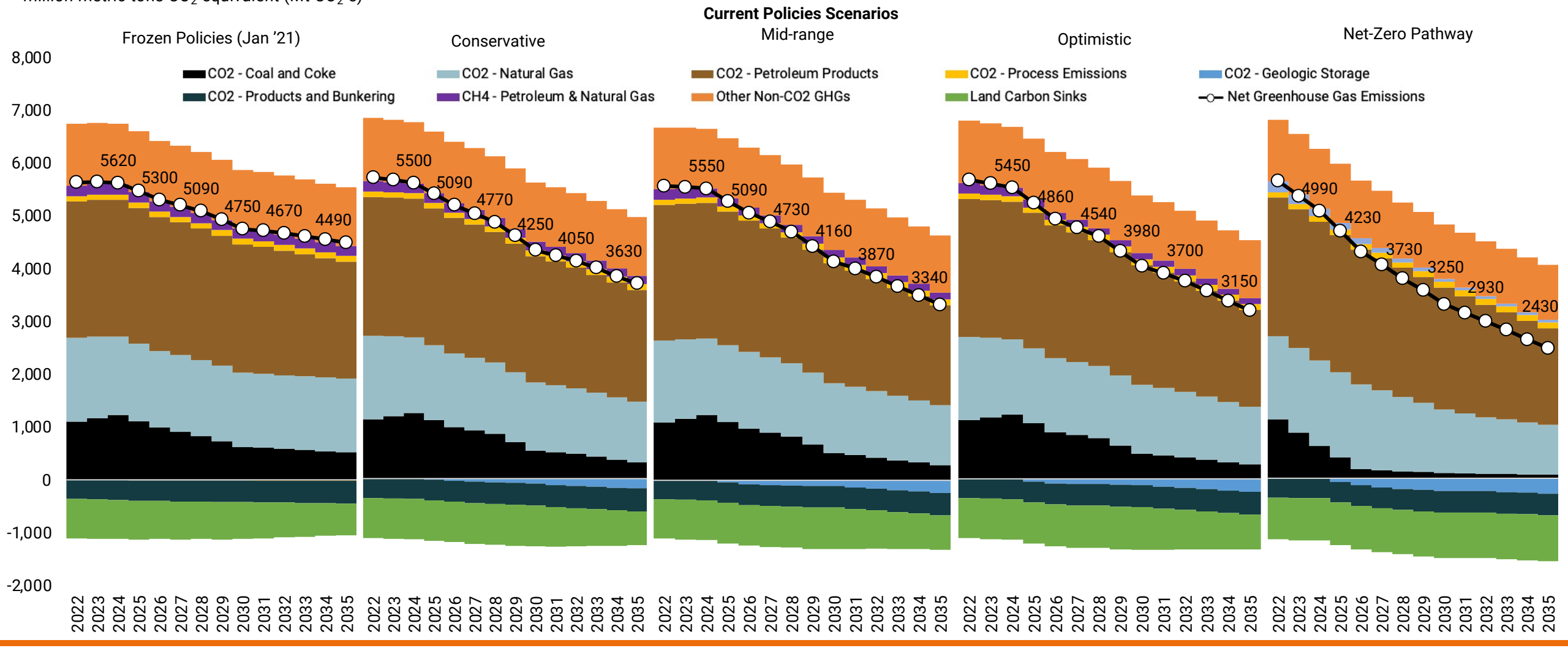
See additional Notes 1-2 on prior page

3 - While transportation electrification under *IRA* scenarios largely aligns with the *Net-Zero Pathway,* accelerated **improvements in internal combustion vehicle fuel efficiency** could further reduce transport sector emissions by ~10 Mt/yr in 2030 and ~10-30 Mt/yr in 2035.

4 – In Current Policies scenarios, solar capacity additions are already constrained through 2035 and wind capacity additions are close to constraints. Additional **reductions in coal-fired generation** would therefore likely be compensated primarily by increases in gas-fired generation. Displacing ~400-450 TWh of remaining coal generation in 2030 with gas CCGTs would result in a net reduction of ~0.2 GtCO2-e/year. Deeper reductions could potentially be achieved via deployment of carbon capture in the power sector, which is minimal in these revised REPEAT Project results.

Annual Greenhouse Gas Sources and Sinks

million metric tons CO_2-equivalent (Mt CO_2-e)[1,2]



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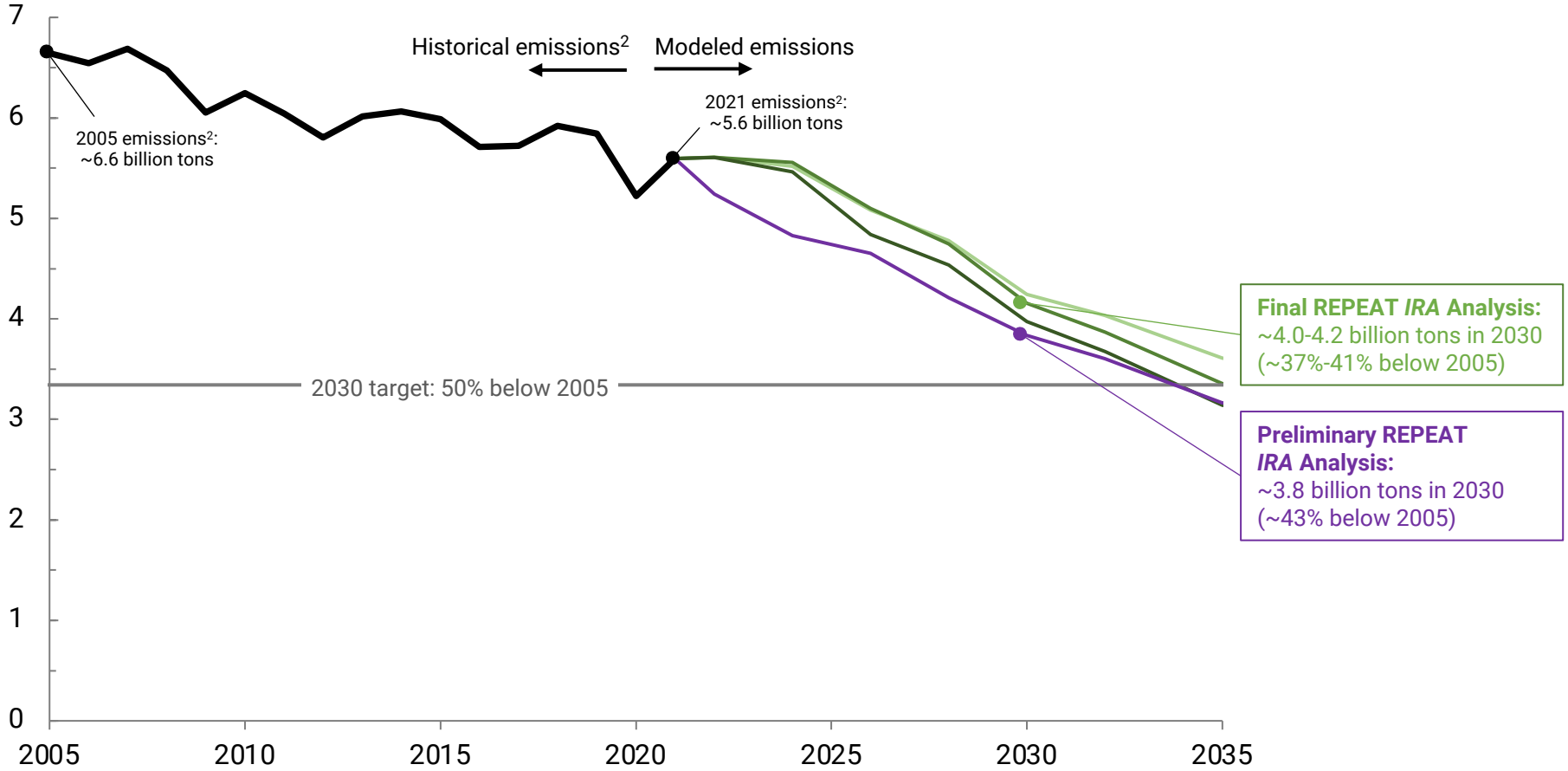
1 - CO_2-equivalent emissions calculations use IPCC AR4 100 year global warming potential as per EPA Inventory of Greenhouse Gas Emissions and Sinks. All values rounded to nearest 10 M/yr. **All values should be regarded as approximate given uncertainty in future outcomes.**

2 - Modeled emissions exclude any changes in passenger and freight miles traveled due to surface transportation, rail, and transit investments in IIJA.

Final and Preliminary REPEAT Analysis of the *Inflation Reduction Act*

billion metric tons CO_2-equivalent (Gt CO_2-e) net U.S. greenhouse gas emissions (including land carbon sinks)[1]



Reflecting constraints on supply chains and other rate-limiting factors, this analysis estimates a slower start to the energy systems transformation under Current Policies (including *IRA*) than 'Preliminary' results reported in August, 2022[4]:

- This 'Final' analysis now includes a range of three Current Policies emissions scenarios ('Conservative', 'Mid-range', and 'Optimistic'), better reflecting uncertainty about the impacts of *IRA*.
- 'Preliminary' results generally estimated more rapid increases in EV sales share and more rapid solar PV and wind deployment rates than this 'Final' analysis.
- The 'Optimistic' Final *IRA* scenario and 'Preliminary' scenario converge by 2032.
- See subsequent slide for sector-by-sector comparison of Final & Preliminary results

4 – Jenkins et al. (2022), "Preliminary Report: The Climate and Energy Impacts of the Inflation Reduction Act of 2022, REPEAT Project,, updated September 21, 2022, https://doi.org/10.5281/zenodo.7106218

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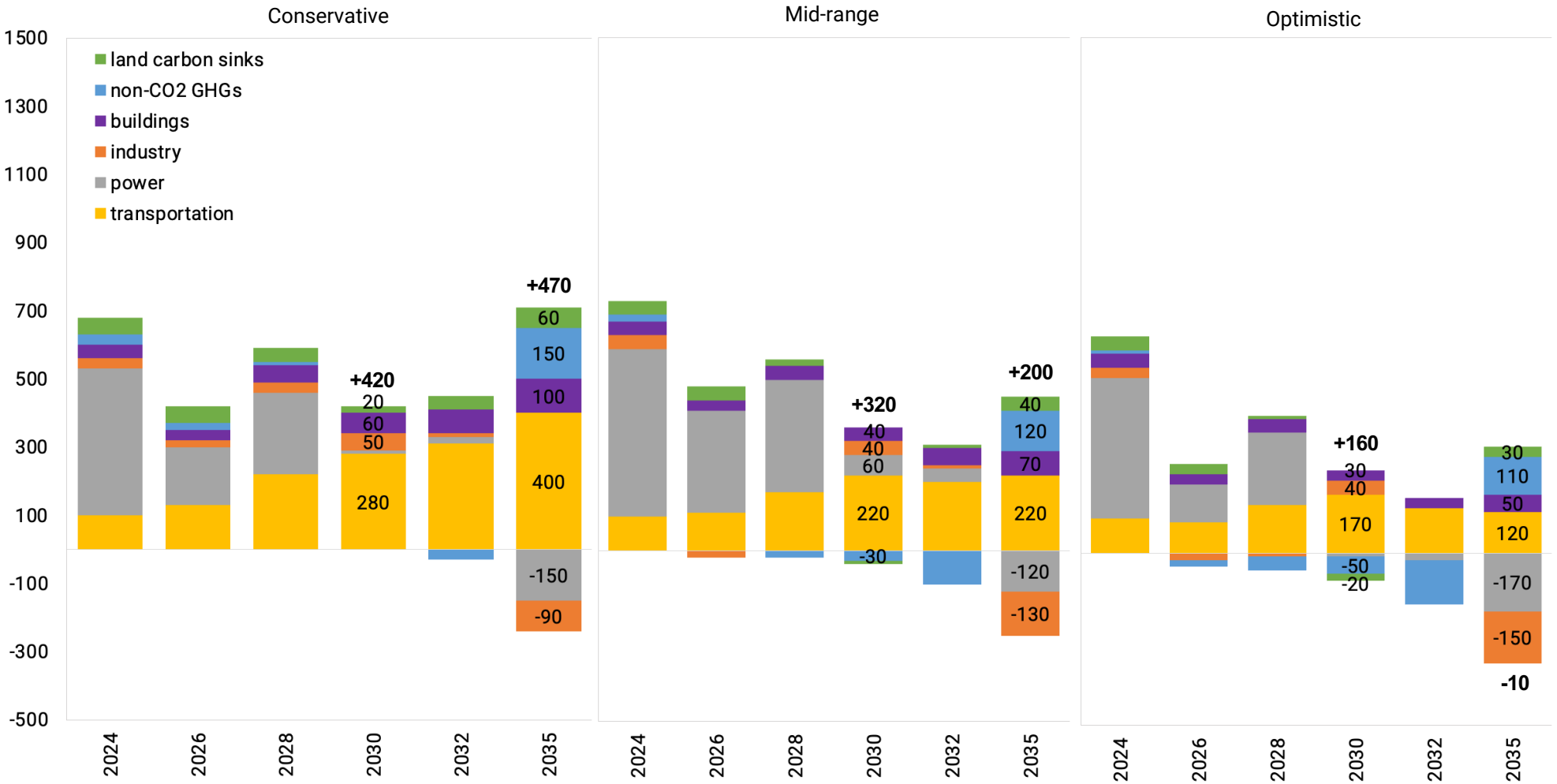
Differences Between Final and Preliminary REPEAT Analysis of the *Inflation Reduction Act* by Scenario

million metric tons CO_2-equivalent (Mt CO_2-e)[1,2,3]



Notes:

1 - CO_2-equivalent emissions calculations use IPCC AR4 100 year global warming potential as per EPA Inventory of Greenhouse Gas Emissions and Sinks. All values rounded to nearest 10 Mt and all values <10 Mt omitted from labels. **All values should be regarded as approximate given uncertainty in future outcomes.**

2 - Modeled emissions exclude any changes in passenger and freight miles traveled due to surface transportation, rail, and transit investments in IIJA. According to the Georgetown Climate Center, emissions impact of these changes depend heavily on state implementation of funding from IIJA, which could result in anywhere from -14 Mt/yr to +25 Mt/yr change in CO_2 emissions from transportation in 2030.

3 – Differences vs values reported in Jenkins et al. (2022), "Preliminary Report: The Climate and Energy Impacts of the Inflation Reduction Act of 2022, REPEAT Project,, updated September 21, 2022, https://doi.org/10.5281/zenodo.7106218

Stay tuned for full report and state-level data portal...