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 2022¹ 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 Policies² 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.
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 117\(^{th}\) 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

**Princeton ZERO Lab**: Prof. Jesse D. Jenkins (PI), Dr. Greg Schivley;

**Dartmouth College**: Prof. Erin Mayfield (co-PI);

**Binghamton University**: Prof. Neha Patankar;

**Evolved Energy Research**: Ryan Jones, Jamil Farbes;

**Former contributors**: Princeton: Dr. Qingyu Xu; Annie Jacobson, Claire Wayner, Aneesha Manocha, Riti Bhandakar, Cady Feng; Montara Mountain Energy: Emily Leslie, Dr. Andrew Pascale.

Website development by **Hyperobjekt**.

---

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

billion metric tons CO₂-equivalent (Gt CO₂-e)

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

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)

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

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 - CO₂-equivalent emissions calculations use IPCC AR4 100 year 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 CO₂ emissions from transportation in 2030.

billion metric tons CO₂-equivalent (Gt CO₂-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)²

Current Policies, including the Inflation Reduction Act (IRA):
~4.0-4.2 billion tons in 2030
(~37%-41% below 2005)²

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 - CO₂ 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 - 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 CO₂ emissions from transportation in 2030.
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 CO₂-equivalent (Mt CO₂-e)¹,²

<table>
<thead>
<tr>
<th>Year</th>
<th>Land Carbon Sinks</th>
<th>Non-CO₂ GHGs</th>
<th>Buildings</th>
<th>Industry</th>
<th>Power</th>
<th>Transportation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2024</td>
<td>100</td>
<td>90</td>
<td>120</td>
<td>220</td>
<td>180</td>
<td>+1000</td>
</tr>
<tr>
<td>2026</td>
<td>190</td>
<td>180</td>
<td>200</td>
<td>210</td>
<td>150</td>
<td>+220</td>
</tr>
<tr>
<td>2028</td>
<td>510</td>
<td>60</td>
<td>110</td>
<td>560</td>
<td>210</td>
<td>+900</td>
</tr>
<tr>
<td>2030</td>
<td>100</td>
<td>150</td>
<td>150</td>
<td>40</td>
<td>70</td>
<td>+910</td>
</tr>
<tr>
<td>2032</td>
<td>260</td>
<td>210</td>
<td>160</td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2035</td>
<td>210</td>
<td>240</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 opportunities³ 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 CO₂-equivalent (Mt CO₂-e)\textsuperscript{1,2}

Frozen Policies (Jan '21)
- C02 - Coal and Coke
- C02 - Natural Gas
- C02 - Products and Bunkering

Conservative
- C02 - Petroleum Products
- CH4 - Petroleum & Natural Gas

Mid-range
- C02 - Process Emissions
- Other Non-C02 GHGs

Optimistic
- C02 - Geologic Storage

Net-Zero Pathway
- Net Greenhouse Gas Emissions

Current Policies Scenarios

1. CO₂-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.
Historical emissions 2 Modeled emissions

Historical emissions:
~6.6 billion tons

2005 emissions:
~6.6 billion tons

2021 emissions:
~5.6 billion tons

2030 target: 50% below 2005

Final REPEAT IRA Analysis:
~4.0-4.2 billion tons in 2030 (~37%-41% below 2005)

Preliminary REPEAT IRA Analysis:
~3.8 billion tons in 2030 (~43% below 2005)

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:

- 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

1 - CO2 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 2005-2030; 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 to +25 Mt change in CO2 emissions from transportation in 2030.

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

million metric tons CO₂-equivalent (Mt CO₂-e)¹,²,³

Notes:
1 - CO₂-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 CO₂ emissions from transportation in 2030.

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