Future Climate Policies

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2023 IPCC AR6 Synthesis Report – Global emission pathways

2022 - 2023 emissions are outside of the IPCC range.
Goals vs Reality

COP-28: “transitioning away from fossil fuels in energy systems, in a just, orderly and equitable manner ... so as to achieve net zero by 2050 in keeping with the science.”

MIT Current Trends:
current policies

MIT Accelerated Actions by 2050: Advanced economies: 70-80% reduction; Emerging economies: 50-75% reduction

https://globalchange.mit.edu/
**Current Trends (CT) Scenario**

*Current Trends:* By 2060, more than half of the IGSM ensemble’s Paris Forever projections exceed 2°C global climate warming, a figure that rises to more than 75% by early 2070s and more than 95% by 2085.

**Accelerated Actions (AA) Scenario**

Under *Accelerated Actions*, by midcentury global temperature rise will cease and decline slightly before stabilizing through the latter half of the century and into the 22nd century (to just below 1.5°C median warming).

http://globalchange.mit.edu/
Minimize the impacts of overshoot

**Avoided damages**

**vs**

**Cost of action**

**Higher Overshoot:**

Larger climate damages

**but**

smaller initial (overall? discounted?) cost of policy

**Other aspects:** biodiversity, equity, finance...
Carbon pricing by region in 2024

Overview of regional, national and subnational carbon pricing initiatives

Argentina 3
Canada 50-60 (C$65-C$80)
China 8
Colombia 5
EU 65 (60 Euro)
Japan 2
Kazakhstan 1
Korea 11
New Zealand 35
Singapore 4
South Africa 9

https://carbonpricingdashboard.worldbank.org/map_data
MIT 2023 Outlook: Carbon prices in different scenarios

Compare to IEA (2023):
2050 carbon prices
Countries with zero-emission pledges: $200-250/tCO₂
Others: $180/tCO₂
Yet others: $55/tCO₂

Source: MIT Global Change Outlook (2023)
# Inflation Reduction Act

## Environmental Impacts of the Inflation Reduction Act

Documentation of the USREP-ReEDS Model Analysis

Prepared for

U.S. Environmental Protection Agency
Climate Economics Branch
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## Table ES.1

Summary of ranges of CO₂ emissions reductions from 2005

<table>
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<tr>
<th>Sector</th>
<th>Year</th>
<th>IRA</th>
<th>No IRA</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Min</td>
<td>Median</td>
</tr>
<tr>
<td>Electricity</td>
<td>2030</td>
<td>49%</td>
<td>69%</td>
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<tr>
<td></td>
<td>2035</td>
<td>67%</td>
<td>77%</td>
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<tr>
<td>Transportation</td>
<td>2030</td>
<td>11%</td>
<td>17%</td>
</tr>
<tr>
<td></td>
<td>2035</td>
<td>15%</td>
<td>27%</td>
</tr>
<tr>
<td>Buildings</td>
<td>2030</td>
<td>49%</td>
<td>55%</td>
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<tr>
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<td>Industry</td>
<td>2030</td>
<td>17%</td>
<td>36%</td>
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<tr>
<td></td>
<td>2035</td>
<td>23%</td>
<td>36%</td>
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<tr>
<td>Economy-Wide</td>
<td>2030</td>
<td>35%</td>
<td>39%</td>
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<tr>
<td></td>
<td>2035</td>
<td>36%</td>
<td>46%</td>
</tr>
</tbody>
</table>
Global Energy and GHG

Need for negative emissions

Net-zero CO\textsubscript{2} (not net-zero GHG)

Source: IPCC (2022)
Also important: Demand Side Management
MIT Economic Projection and Policy Analysis (EPPA) Model

Multi-sector, multi-region computable general equilibrium (CGE) model of the world economy for energy, economy and emissions projections

Key Features
- Global Coverage & International Trade
- Economy-Wide Coverage & Inter-Industry Linkages
- Feedbacks Across Regions & Sectors
- Endogenously modeled: Prices, Investments & Capital Accumulation
- GDP and Welfare Effects
- Policies (emissions limits/prices, sector/technology regulations, etc.)
- Distortions (taxes, subsidies, etc.)
- Accounting for Physical Quantities (energy, electricity, land, etc.)

*Regions and sectors can be added for special studies*

Full Input-Output Data for Every Region

Key Inputs
- Policy Assumptions
- Population Growth
- Capital/Labor Productivity Growth
- Energy Efficiency Improvements
- Technology Costs
- Rate of Technology Penetration
- Elasticities of Substitution
- Fossil Fuel Resource Availability
- Urban Pollutant Initial Inventories & Trends
- Land Productivity

Technical Features
- Written in GAMS using MSPGE
- Based on GTAP Database
- Calibrated to current economic and energy levels based on IMF and IEA
- Documented in peer-reviewed literature
- Publicly Available Version 2100+ (in 5-year steps)

18 Regions

EPPA regions:
- AFR Africa
- ANZ Australia & New Zealand
- OLA Other Latin America
- AMI Dynamic Asia
- BRA Brazil
- CAN Canada
- CML Middle East
- COR China
- EUR Europe
- IND India
- JPN Japan
- KOR Korea
- MEX Mexico
- NOT Other East Asia
- OEC Other Europe
- PIN Indonesia
- ROS Russia
- USA United States

Key Equations
- **Firms maximize profit**: choose technology, level of output and inputs subject to production functions and costs
  - Advanced Nuclear
  - Hydro
  - Solar
  - Wind
  - Renewables with Backup
- **Household maximize welfare**: choose savings and consumption subject to budget constraint
  - Biomass
  - Biomass with CCS

Equilibrium Conditions: Market-Clearing, Zero-Profit, Income Balance

Key Outputs
- GDP
- Consumption
- Emissions (GHGs, Air Pollutants)
- Primary/Final Energy Use
- Electricity Generation
- Technology Mix
- Commodity and Factor Prices
- Sectoral Output
- Land Use
- *At global and regional levels*

*New Technologies Continually Added*

Key Features
- **At global and regional levels**

https://globalchange.mit.edu/research/research-tools/human-system-model
Examples of recent applications of MIT tools: variety of research efforts

Costs of Net-Zero Targets

Decarbonizing Hard-to-Abate Sectors

Reality of Direct Air Capture

Climate Change Effects on Agriculture

Cost and Value of Variable Renewables

Global Electrification of Light-Duty Vehicles

Economics of Bioenergy with CCS (BECCS)

Impacts of Border Carbon Adjustments

Transition Scenarios for Financial Risk Analysis

Climate-Related Financial Stress-Testing

MIT 2023 Global Change Outlook
Charting the Earth’s Future Energy, Managed Resources, Climate, and Policy Prospects
https://globalchange.mit.edu

Published every other year
Thank you

Questions or comments?
Please contact Sergey Paltsev at paltsev@mit.edu