U.S. Environmental Protection Agency
Office of Atmospheric Programs

EPA Analysis of Bingaman-Specter Request on Global CO_2 Concentrations

October 1, 2007

Request for EPA Analysis

- On July 26, 2007 Senators Bingaman and Specter requested that EPA estimate the economic impacts of the Low Carbon Economy Act of 2007 (S.1766).
- The request had two main parts:
  1) Analyze S.1766 in line with assumptions used for EPA's analysis of S.280 and other additional sensitivities. The results of this first request is to due to the Senators' offices by November 15, 2007.
  2) Evaluate CO_2 concentrations from:
     a) a historical perspective showing individual nation's and region's contributions to current concentrations; and
     b) a projections perspective showing the effects of the emissions targets of three bills:
        1. Lieberman-McCain, "Climate Stewardship and Innovation Act," (S.280),
        2. Kerry-Snowe, "Global Warming Reduction Act," (S.485),
        3. Bingaman-Specter, "Low Carbon Economy Act," (S.1766).

The work presented here is the response to the second part of the request, and thus does not Include an analysis of the costs or economic impacts of achieving the specified reductions.

- The analysis was conducted by EPA's Office of Atmospheric Programs.

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Key Results and Insights

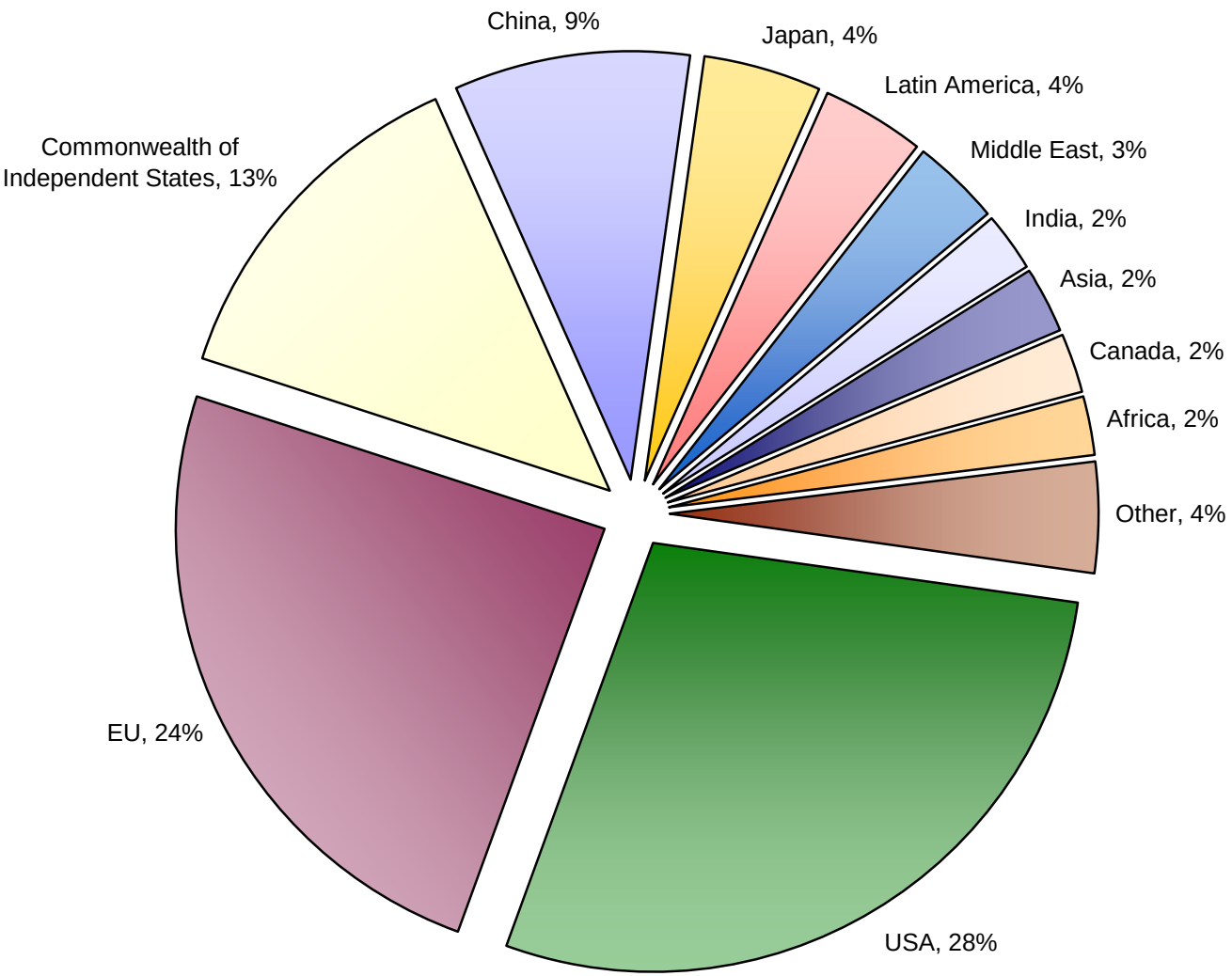
Historic contributions to CO_2 Concentrations

- CO_2 from energy 1850 – 2000
  - Energy related CO_2 emissions from four regions (USA, EU, Commonwealth of Independent States, and China) contribute to 74% of the increase in CO_2 concentrations over the period 1850 – 2000.
  - Energy related CO_2 emissions from the rest of the world contributes to the remaining 26% of the increase in CO_2 concentrations in this period, with no individual country contributing more than 4%
- CO_2 from energy and land use change 1950 - 2000
  - When considering both energy related CO_2 emissions and emissions from land-use change over the more recent period of 1950 – 2000, the contribution to the increase in CO_2 concentrations is much more evenly shared.
  - USA, EU25, CIS, and China combined contribute to 55% of the increase in CO_2 concentrations.
  - Asia, Latin America, and Africa combined contribute to 30% of the increase in CO_2 concentrations.

Projected CO_2 concentrations and effects of the emissions targets of three climate bills

- The three bills achieve similar levels of cumulative GHG emissions abatement.
  - Bingaman-Specter assumptions:
    - The Technology Accelerator Payment (TAP) is not triggered.
    - 2050 targets of 60 percent below 2006 emissions levels are adopted.
- Compared to Lieberman-McCain (S. 280), Bingaman-Specter (S. 1766) requires a smaller percentage reduction of emissions in covered sectors, but since S. 1766 has broader coverage than S. 280, the total abatement achieved by both bills is similar.
- Given the assumption that international actions are the same, the three bills all have a nearly identical effect on CO_2 concentrations at the end of the century.

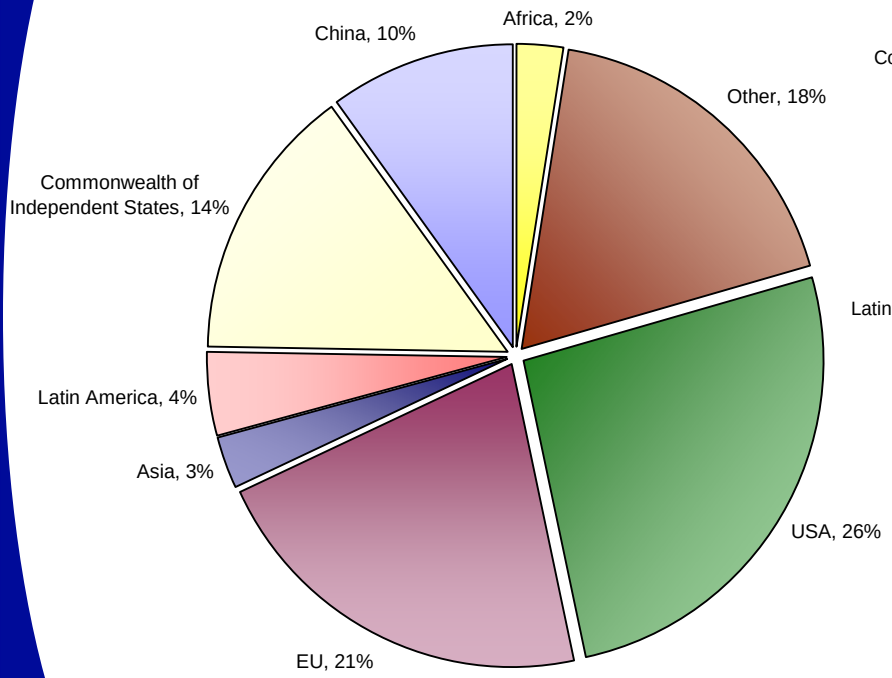
Historic Contributions to CO_2 Concentrations 1850-2000 (CO_2 from Energy)



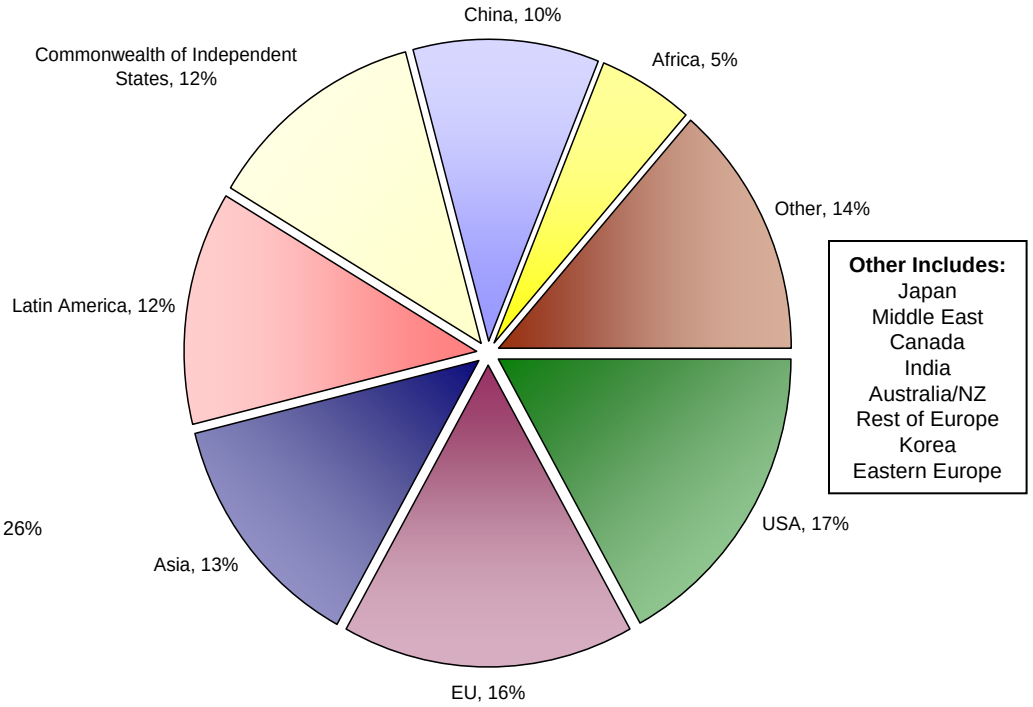
Source: Climate Analysis Indicators Tool (CAIT) Version 4.0. (Washington, DC: World Resources Institute, 2007)

Historic Contributions to CO_2 Concentrations 1950-2000

CO_2 from Energy



CO_2 from Energy and Land-Use Change



Source: Climate Analysis Indicators Tool (CAIT) Version 4.0. (Washington, DC: World Resources Institute, 2007)

U.S. GHG Caps and Coverage

- The specified caps on covered emissions for the three bill vary:
  - Bingaman-Specter (S. 1766) calls for reducing covered emissions to 60% below *2006* levels in 2050,
  - Lieberman-McCain (S. 280) calls for reducing covered emissions to 60% below *1990* levels in 2050,
  - Kerry-Snowe (S. 485) calls for reducing covered emissions to at least 65% below *1990* levels in 2050.
- S. 1766 has broader coverage than S. 280 or S. 485.
  - S. 280 caps transportation upstream on fuels; and electricity, industrial, and commercial sectors downstream on emissions.
    - Entities that emit less than 10,000 tCO_2e per year within sectors that are covered downstream are exempted, and the cap level is adjusted downward by the amount of emissions from exempted sources. This exemption includes 90% or the emissions from the commercial sector.
    - Energy related CO_2 emissions from the residential and agricultural sectors are not covered.
  - S. 485 is assumed to have the same coverage as S. 280.
  - S. 1766 caps all emissions upstream on fuels.
    - The upstream caps on fuels cover virtually all CO_2 emissions from fossil fuel combustion, including energy related CO_2 emissions from the agricultural, commercial, and residential sectors.
  - All three bills have similar coverage of Non-CO_2 greenhouse gases.
- S. 1766 and S. 280 generate similar cumulative emissions reductions; while S. 485 generates slightly greater cumulative emissions reductions than the other two bills.

Scenarios

Reference Scenario

- Reference scenario emissions come from the Climate Change Science Program (CCSP) Synthesis and Assessment Product 2.1a MiniCAM reference case.
- The CCSP SAP 2.1a reference case assumes that in the post-2012 period existing measures to address climate change expire and are never renewed or replaced.

Scenarios Without International Action

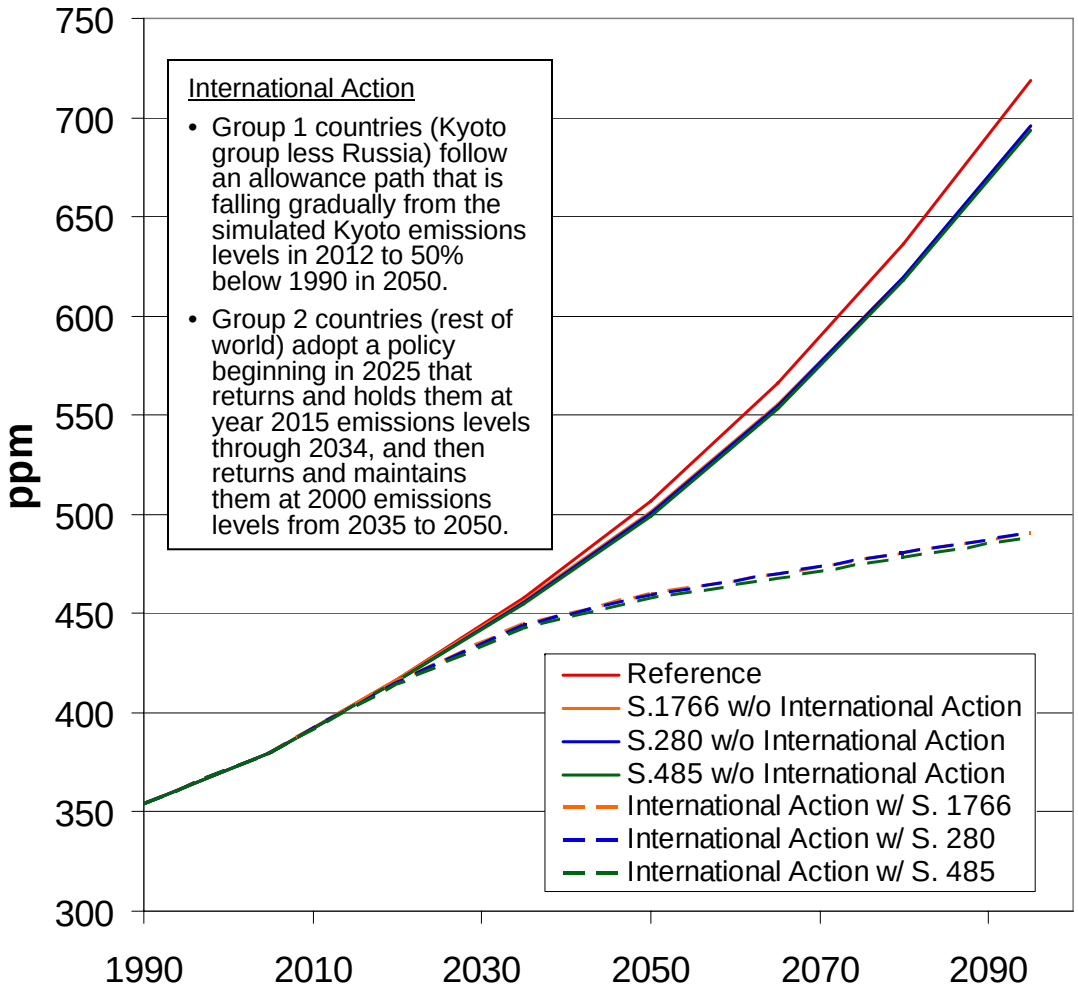
- USA adopts Bingaman-Specter (S. 1766) , Lieberman-McCain (S. 280), or Kerry-Snowe (S. 485).
- S. 1766 Assumptions:
  - The Technology Accelerator Payment (TAP) is not triggered.
  - 2050 targets of 60 percent below 2006 emissions levels are adopted.
- All other countries adopt no additional policies or measures.

Scenarios with International Action

- USA adopts S. 1766, S. 280, or S. 485.
- S. 1766 Assumptions:
  - The TAP is not triggered.
  - 2050 targets of 60 percent below 2006 emissions levels are adopted.
- Widespread international actions by developed and developing countries over the modeled time period. International policy assumptions are based on those used in the recent MIT report, “Assessment of U.S. Cap-and-Trade Proposals”
  - Group 1 countries (Kyoto group less Russia) follow an allowance path that is falling gradually from the simulated Kyoto emissions levels in 2012 to 50% below 1990 in 2050.
  - Group 2 countries (rest of world) adopt a policy beginning in 2025 that returns and holds them at year 2015 emissions levels through 2034, and then returns and maintains them at 2000 emissions levels from 2035 to 2050.
- After 2050, all countries hold emissions caps constant at 2050 levels.

The effects of the TAP, and the effects of trade and emissions leakage –analyzed in detail for the final legislative analysis– will be used to update this concentrations assessment if warranted.

Global CO_2 Concentrations (MiniCAM)



* Reference scenario emissions come from the Climate Change Science Program (CCSP) Synthesis and Assessment Product 2.1a MiniCAM reference case.

In the reference scenario,* Global CO2 concentrations rise from historical levels of 354 parts per million (ppm) in 1990 to 718 ppm in 2095.

Effect of S. 1766, S. 280, and S. 485

Assuming no one in the international community changes their current policies, the global CO_2 concentrations in 2095 are estimated as follows:

- If the U.S. adopts either S. 1766 or S.280, CO_2 concentrations in 2095 are estimated to be 23 ppm lower than the reference scenario, or 696 ppm.
- If the U.S. adopts S. 485, CO_2 concentrations in 2095 are estimated to be 25 ppm lower than the reference scenario, or 694 ppm.

Effect of International Action plus Senate Bills

Assuming the international community takes the actions described in the diagram to the left, the global CO2 concentrations in 2095 are estimated as follows:

- If the international community takes action and the U.S. adopts S. 1766 or S. 280, CO2 concentrations are reduced from 718 ppm to 491 ppm in 2095, to which the U.S. contributes a 23 ppm reduction.
- If the international community takes action and the U.S. adopts S. 485, CO2 concentrations are reduced from 718 ppm to 489 ppm in 2095, to which the U.S. contributes a 25 ppm reduction.
- While CO_2 concentrations are significantly reduced in the scenarios with international action, they are not on a stabilization trajectory.

The work presented here does not include an assessment of the costs or economic impacts associated with achieving the specified reductions. EPA is currently producing an analysis of the economic impacts of S. 1766 that is due to the Senators' offices by November 15, 2007. EPA's economic analysis of S. 280 is available at: www.epa.gov/climatechange/economicanalyses.html

Global CO_2 Concentrations (MiniCAM)

- The cumulative global GHG emissions reductions over the entire century are similar under all three bills.
  - Cumulative International GHG emissions reductions are assumed to be identical under all three bills (2443 bmt CO_2e over the 2005 – 2095 time period in scenarios with international action, 0 bmt CO_2e in scenarios without international action).
  - The cumulative U.S. GHG emissions reductions over the entire century under the three bills span a range of 45 bmt CO_2e.

U.S. Cumulative GHG Emissions Reductions (Billion Metric Tons CO_2e)

	2005 - 2050	2005 - 2095
S. 1766	87	326
S. 280	102	335
S. 485	126	371

  - Cumulative U.S. GHG emissions reductions under S. 1766 are 87 bmt CO_2e over the 2005 – 2050 time period, and 326 bmt CO_2e over the 2005 – 2095 time period.
  - Cumulative U.S. GHG emissions reductions under S. 280 are 102 bmt CO_2e over the 2005 – 2050 time period, and 335 bmt CO_2e over the 2005 – 2095 time period.
  - Cumulative U.S. GHG emissions reductions under S. 485 are 126 bmt CO_2e over the 2005 – 2050 time period, and 371 bmt CO_2e over the 2005 – 2095 time period.
- Since the variations in cumulative global GHG emissions reductions under the three bills are small, the variations in the resulting CO_2 concentrations are small.

Mini-Climate Assessment Model (MiniCAM)

- The MiniCAM is a highly aggregated integrated assessment model that focuses on the world's energy and agriculture systems, atmospheric concentrations of greenhouse gases (CO_2 and non-CO_2) and sulfur dioxide, and consequences regarding climate change and sea level rise.
- It has been updated many times since the early eighties to include additional technology options. MiniCAM is capable of incorporating carbon taxes and carbon constraints in conjunction with the numerous technology options including carbon capture and sequestration.
- The model has been exercised extensively to explore how the technology gap can be filled between a business-as-usual emissions future and an atmospheric stabilization scenario.
- The MiniCAM model is designed to assess various climate change policies and technology strategies for the globe over long time scales. It is configured as a partial equilibrium model that balances supply and demand for commodities such as oil, gas, coal, biomass and agricultural products.
- The model runs in 15-year time steps from 1990 to 2095 and includes 14 geographic regions.
- The model is developed and run at the Joint Global Change Research Institute, University of Maryland. Model Homepage**:** http://www.globalchange.umd.edu