Economic and GHG Impacts of EPA Analyzed U.S. Legislative Proposals

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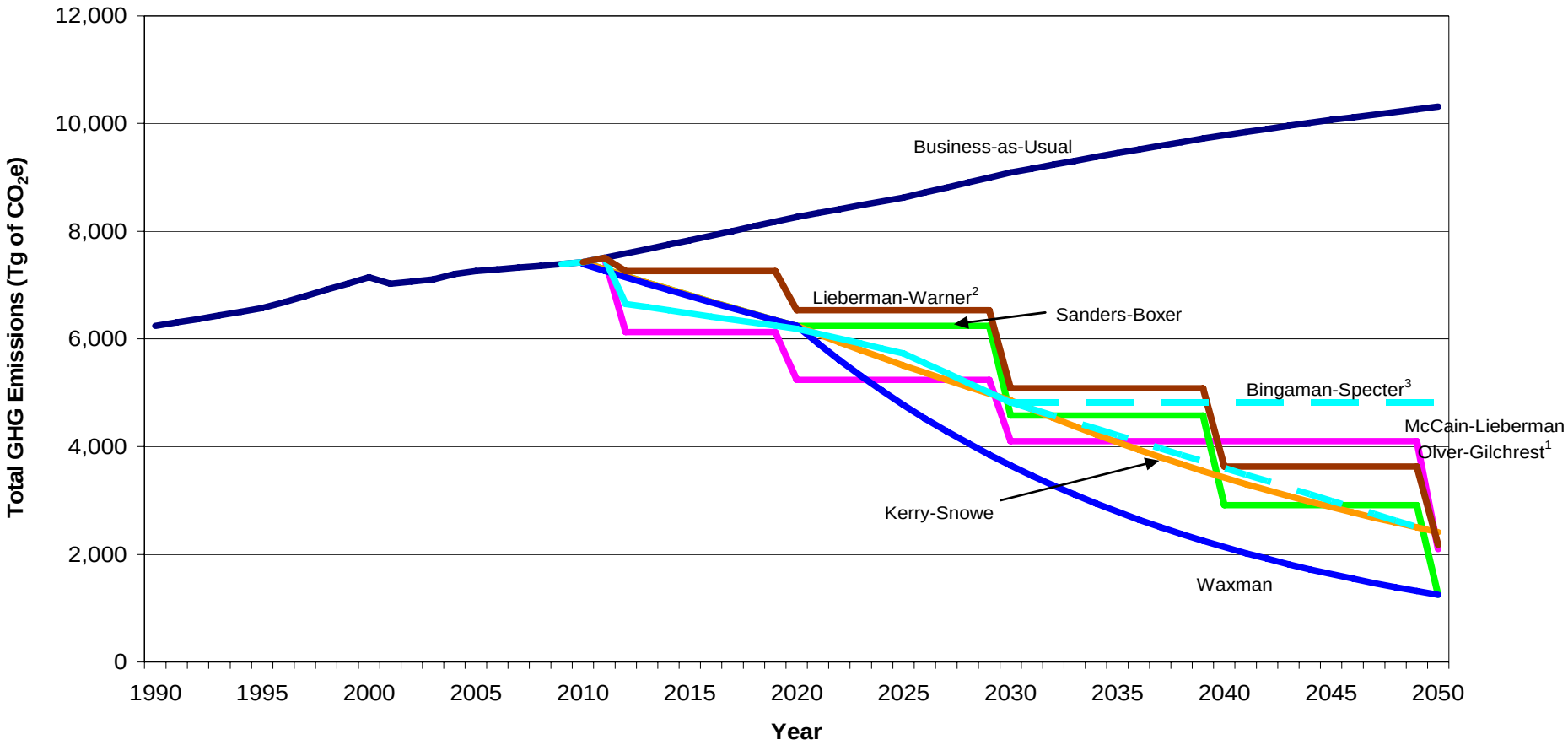
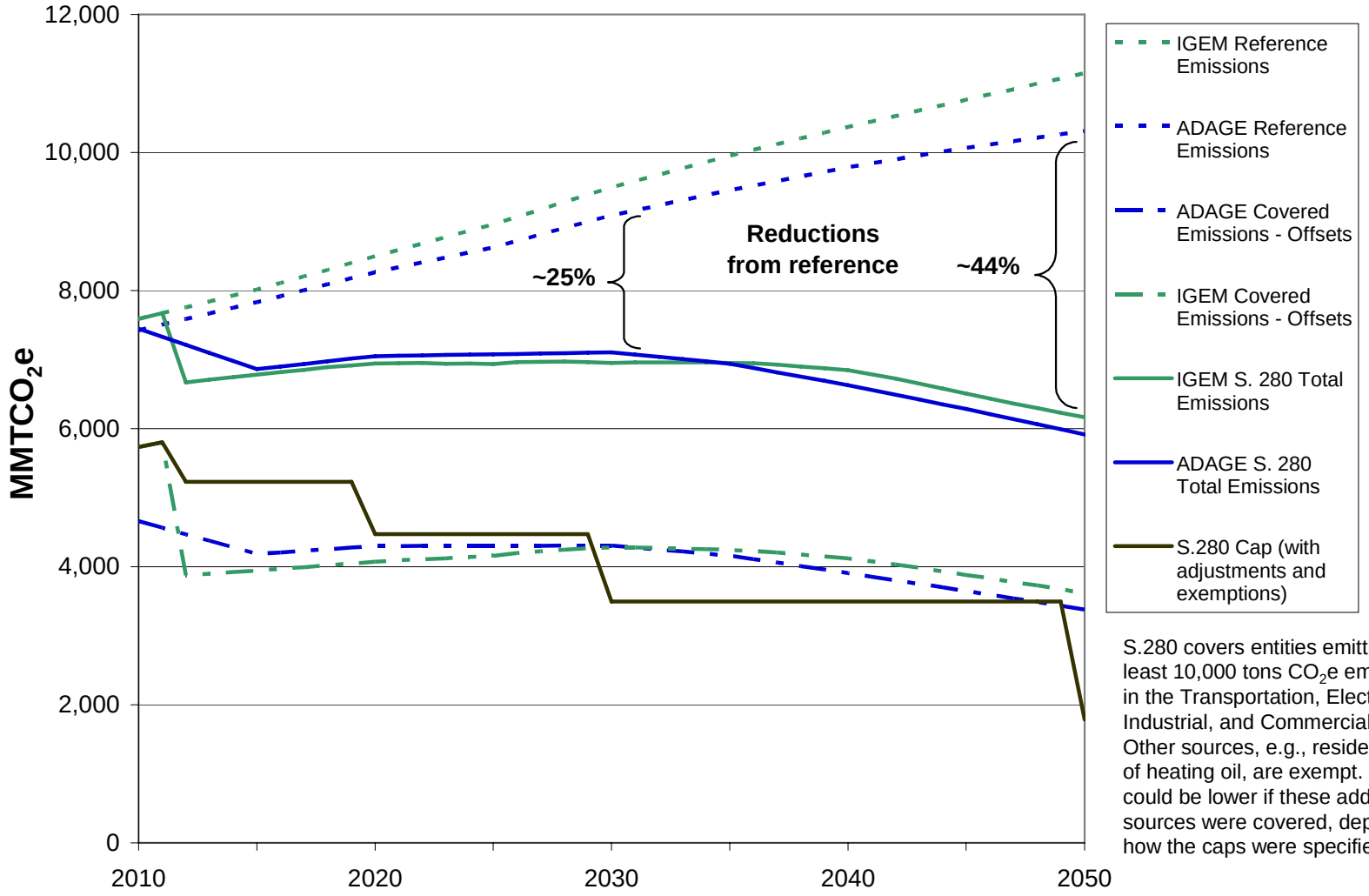


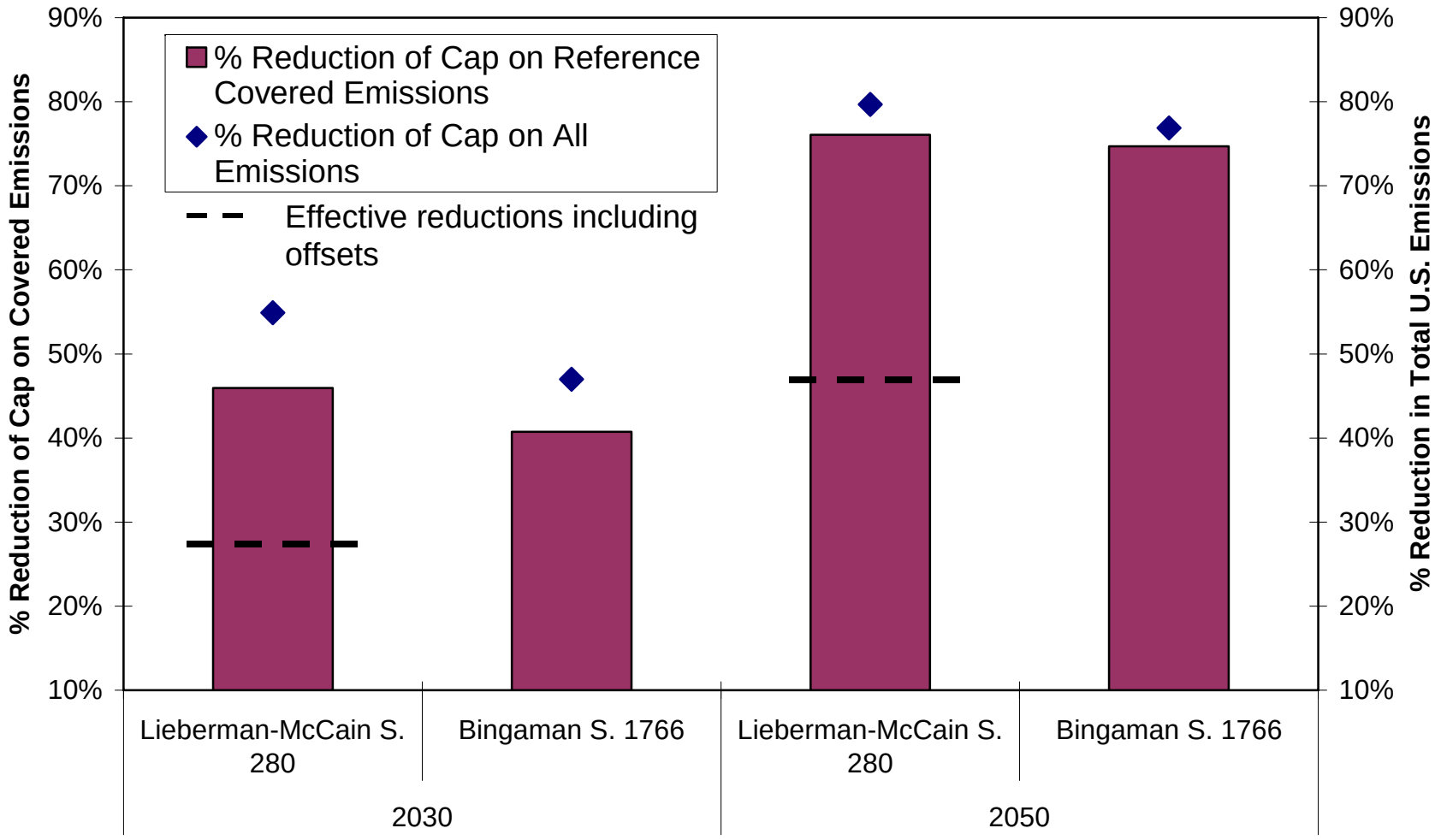
(1) Companion Bills; (2) Based on draft outline introduced Aug 2, 2007. Will be revised when bill is introduced in Sep 2007; (3) 2030 cap held constant through 2050 unless provision enacted to target 60% below 2006 levels in 2050

U.S. GHG Emissions Results from Analysis of the Lieberman-McCain Bill (S. 280)



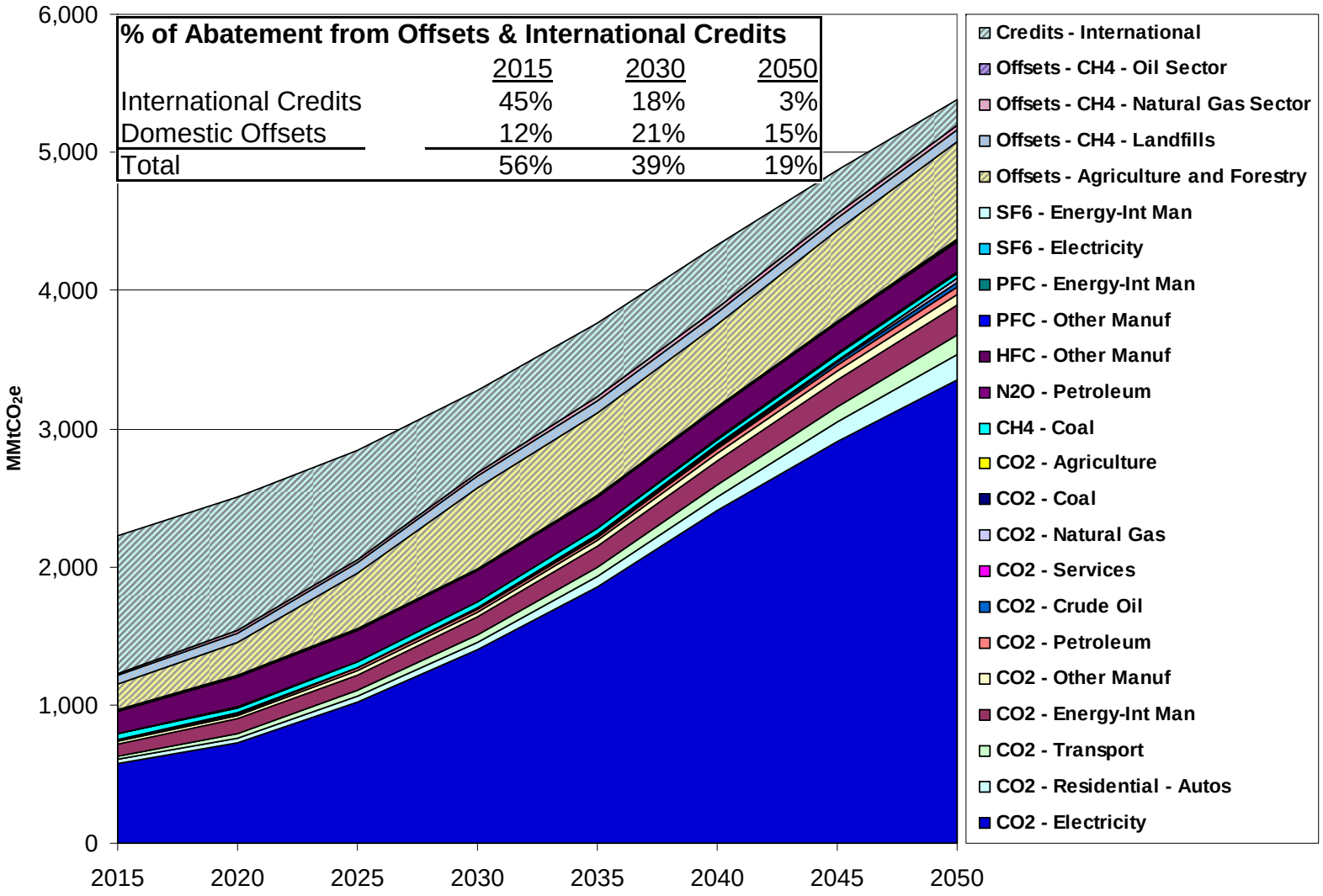
S.280 covers entities emitting at least 10,000 tons CO_2e emissions/yr in the Transportation, Electricity, Industrial, and Commercial sectors. Other sources, e.g., residential use of heating oil, are exempt. Costs could be lower if these additional sources were covered, depending on how the caps were specified.

Assessing Coverage, Stringency, and Offsets



Results: S. 280 Senate Scenario

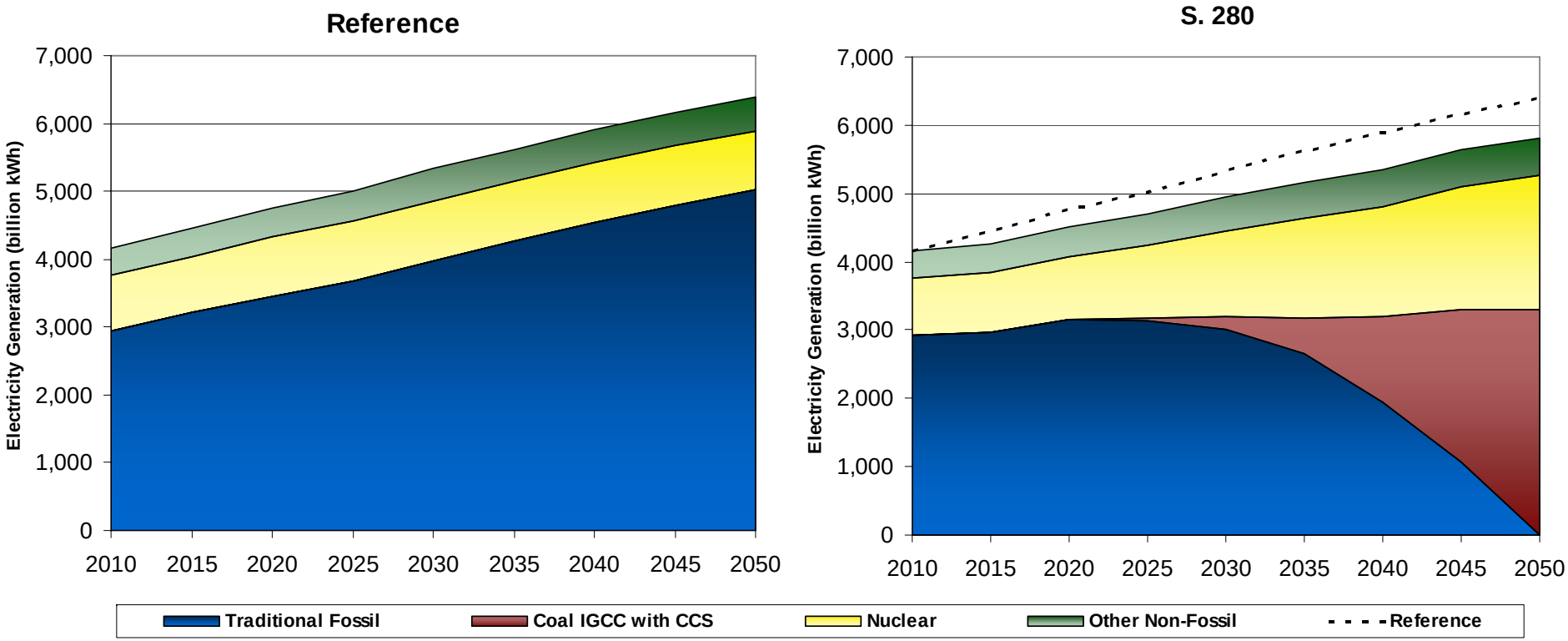
Sources of GHG Abatement (ADAGE)



- S. 280 allows offsets and international credits to make up 30% of the total allowance submissions requirement.
- The quantity of offsets allowed decreases as allowance submissions decrease.
- Since the quantity of offsets allowed is decreasing over time and the quantity of abatement is increasing over time, offsets make up a large fraction of abatement in the early years of the policy, and there contribution to total abatement decreases over time.

Results: S. 280 Senate Scenario

U.S. Electricity Generation, mid-term results (ADAGE)



Note: Other non-fossil includes hydro, geothermal, wind, solar, biomass and municipal solid waste.

Notes: S.280 Key Results & Insights

Emissions Impacts

- Under S. 280 total U.S. GHG emissions are approximately 25% lower than Reference Scenario emissions in 2030, and 44% lower in 2050.
- Purchasing international credits reduces non-U.S. emissions in 2030 by 588 $MMTCO_2e$, which is approximately six percent of U.S. Reference Scenario emissions in that year; and by 254 $MMTCO_2e$ in 2050, which is approximately two percent of U.S. Reference Scenario emissions in that year.
- Under S. 280 covered U.S. GHG emissions make up 79% of total U.S. GHG emissions in 2030, and 74% in 2050.

Sector Impacts

- The greatest emission abatement under S.280 occurs in CO_2 emissions from the electricity sector.
- The transportation sector provides a relatively small proportion of CO_2 emissions abatement. This result reflects the weak and indirect price signal an upstream cap and trade program sends to the transportation sector.
  - The price signal provided by S. 280 (~$0.26 increase in the price of gasoline in 2030, ~$0.68 increase in 2050), does not overcome the market barriers in the transportation sector that prevent larger reductions in GHG emissions.
  - This analysis did not estimate the reductions that could be achieved under a direct fuel and vehicle regulatory framework.

Offsets Sensitivities

- If the 30% limit on the use of offsets is lifted, the allowance price falls by 35% in every year, the effects on GDP and consumption in are reduced by about one third in both 2030 and 2050.
- If offsets are not allowed, the allowance price increases by over 150% in all years.

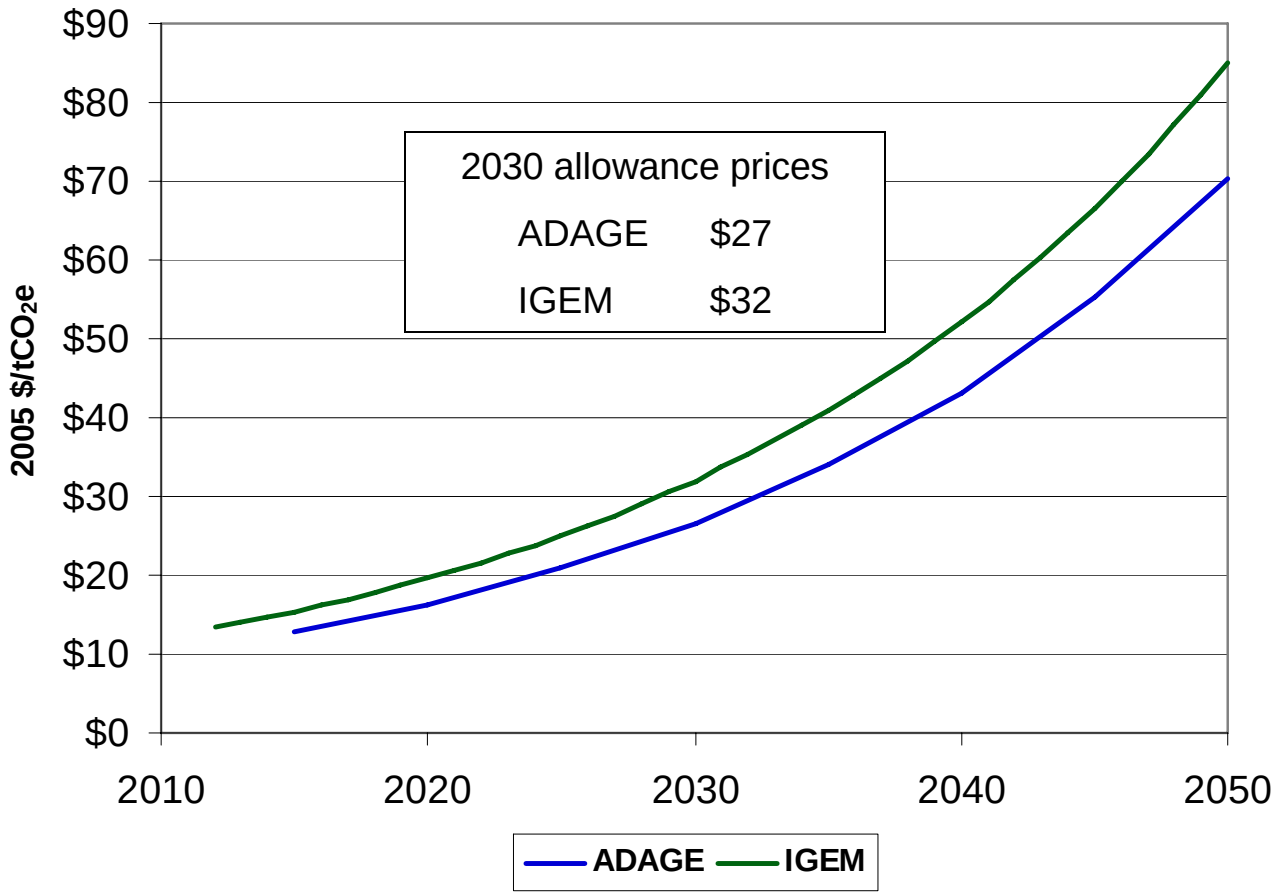
Notes: S.280 Key Results & Insights (con't)

Enabling Technologies

- The enabling technologies in this analysis for electricity generation are Carbon Capture & Storage (CCS) and Nuclear Power.
- Detailed power sector modeling suggests most existing coal plants continue to operate but are less profitable in the near-term; and while economy-wide models indicate the near-term impact on coal may be greater than the impacts in the detailed power sector models, they show that coal usage rebounds after 2030 with the deployment of CCS technology based on assumption on costs and performance of CCS in this analysis.
- CCS is not yet proven on commercial scale but is the focus of considerable R&D funding. In this analysis, while CCS is available starting in 2015, carbon allowance prices rise to a high enough level to make CCS cost-competitive in ~2030 and it is rapidly deployed thereafter.
- If CCS is not deployed, in 2030 allowance prices increase by half and GDP effects are almost doubled from the Senate Scenario.
- In the Senate scenario nuclear power grows by ~150% by 2050. If the growth of nuclear power is constrained to ~ 75% by 2050, allowance prices increase by 5% and GDP effects are increased by 4% in both 2030 and 2050.
- If neither CCS nor nuclear are available at large scales at the cost used in this analysis then the allowance prices and the costs to the economy would increase significantly.

Results: S. 280 Senate Scenario

GHG Allowance Prices



- The $27 - 30 range of 2030 allowance prices only reflects differences in the models and does not reflect other scenarios or additional uncertainties discussed elsewhere.

<u>Comparison with Other Analyses</u>

- The recent MIT report, "Assessment of U.S. Cap-and-Trade Proposals" analyzed several scenarios, none of which directly corresponded to S. 280.
- For comparison, we ran one of the MIT scenarios (203 bmt) with the ADAGE model.
- For the 203 bmt scenario, the MIT analysis gave an allowance price of $41 in 2015 rising at 4%, while the ADAGE model gave a price of $40 in 2015 rising at 5%.

Results: S. 280 Senate Scenario

GDP

Table: Impact of S. 280 on U.S. GDP (Billion 2005 Dollars)

	2010	2020	2030	2040	2050	Average Annual Growth (2010 - 2050)
Reference						
ADAGE	$14,609	$19,821	$26,452	$33,979	$42,723	2.72%
IGEM	$14,733	$19,851	$26,173	$33,716	$41,372	2.61%
S.280						
ADAGE	$14,606	$19,749	$26,306	$33,750	$42,266	2.69%
IGEM	$14,678	$19,645	$25,754	$32,937	$40,040	2.54%
Absolute Change						
ADAGE	-$3	-$72	-$146	-$229	-$457	*-0.03 Percentage Points*
IGEM	-$55	-$206	-$419	-$779	-$1,332	*-0.07 Percentage Points*
% Change						
ADAGE	-0.02%	-0.36%	-0.55%	-0.67%	-1.07%	
IGEM	-0.37%	-1.04%	-1.60%	-2.31%	-3.22%	

Results: S. 280 Senate Scenario

2030 Selected Sectoral Results (IGEM)

Sector	2007	2030				
		Reference		S. 280		
	Output ($Billions)	Output ($Billions)	Percent Change from 2007	Output ($Billions)	Percent Change from 2007	Percent Change from Reference
Personal and business services	4304	8108	88%	8088	88%	0%
Finance, insurance and real estate	2642	6075	130%	6038	129%	-1%
Transportation and warehousing	681	1284	89%	1257	85%	-2%
Food and kindred products	565	1155	104%	1183	109%	2%
Motor vehicles	513	1095	114%	1063	107%	-3%
Electric utilities (services)	384	548	43%	499	30%	-9%
Petroleum refining	296	389	31%	344	16%	-11%
Gas utilities (services)	51	60	20%	56	11%	-8%
Coal mining	29	40	39%	25	-13%	-37%

- Detailed near-term electricity sector modeling in IPM indicates that the decrease in coal usage may be smaller than the decrease shown in the economy-wide models.
- The results for all 35 sectors and for 2050 are available in Appendix 2.

Notes: S.280 Key Results & Insights

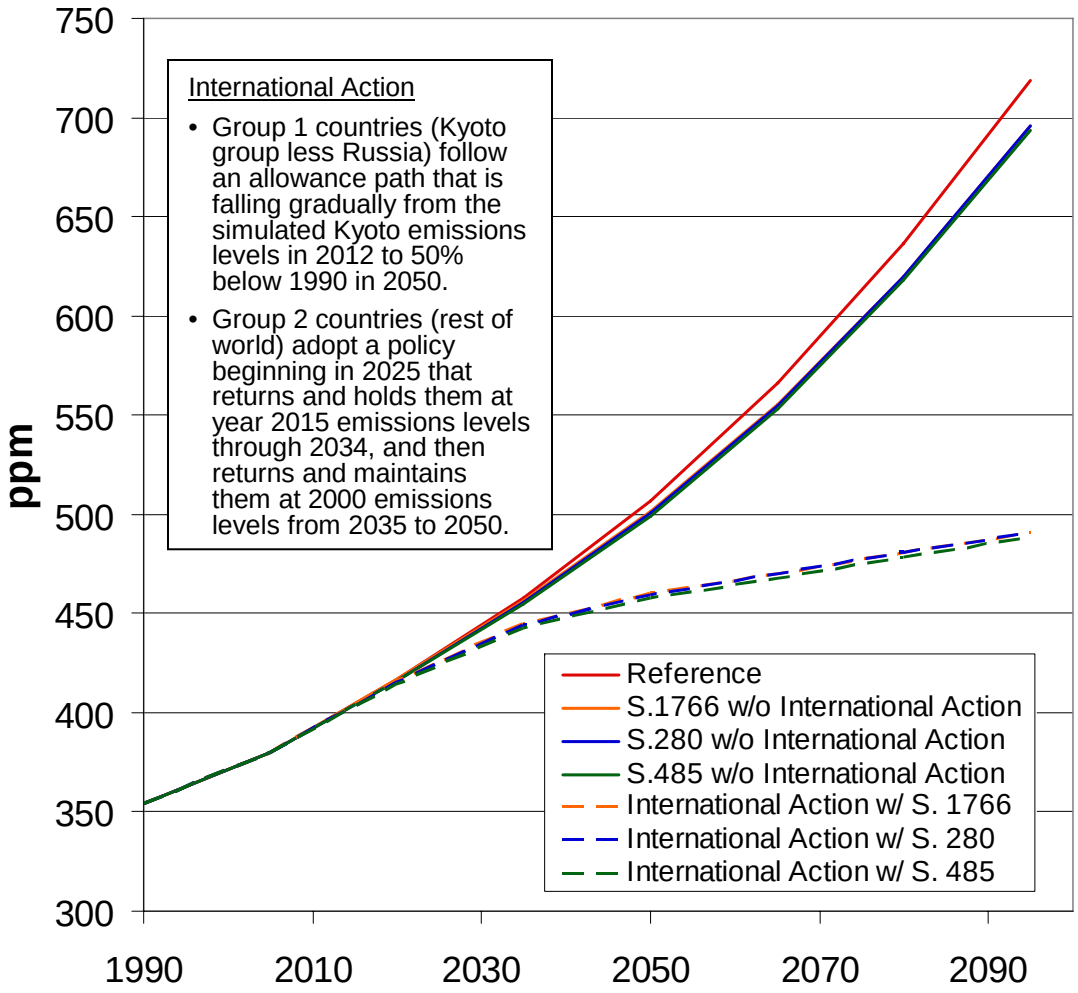
Economic Impacts

- In the Senate Scenario, modeled allowance prices range between $27 - 32 /tCO2e in 2030, and $70 - 85/tCO2e in 2050. In other scenarios that limit the availability of technology, modeled allowance prices range between $28 – 40 /tCO2e in 2030, and $55 – 105 /tCO2e in 2050.
- By 2030 GDP is projected to increase 112% from 2005 levels in the Reference Scenario, and by 2050 the projected increase in GDP from 2005 levels is 238%.
- Under S.280 GDP is modeled to be between 0.6% ($146 billion) and 1.6% ($419 billion) lower in 2030 and between 1.1% ($457 billion) and 3.2% ($1,332 billion) lower in 2050 than in the Reference Scenario.
- The average annual growth rate of consumption is ~ 0.04 percentage points lower. In 2030 per household average annual consumption is ~$550 lower and gasoline prices increase ~$0.26 per gallon. In 2050 per household average annual consumption is ~$1900 lower and gasoline prices increase ~$0.68 per gallon.
- Electricity prices are projected to increase 22% in 2030 and 25% in 2050, assuming the full cost of allowances are passed on to consumers (as is the case in a full auction). If allowances are given directly to power companies, the cost of those allowances would not be passed on to consumers in regulated electricity markets, so electricity price increases would be lower in much of the country.
- In our modeling market outcomes are invariant to the auctioning of allowances given the assumption of lump sum transfers of auction revenues back to households. If the auction revenues were instead used to lower distortionary taxes, the costs of the policy would be lower. Other uses of auction revenues have the potential to increase the costs of the policy.
- The use of domestic offsets and international credits reduces allowance prices and total costs. Payments for international credits are approximately ~$12 billion in 2030 and ~$13 billion in 2050, given the assumption that international credits are purchased only after the supply of domestic offsets at the market clearing price is exhausted.
- The economic benefits of reducing emissions were not determined for this analysis.

Comparisons of three U.S. GHG Cap and Trade Bills

- 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.

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

Notes: Scenarios

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)

- 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 – 2095 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 – 2095 time period, and 335 bmt CO_2e over the 2005 – 2095 time period.
    - Cumulative U.S. GHG emissions reductions under S. 1766 are 126 bmt CO_2e over the 2005 – 2095 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.

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For the report results, go to:
www.epa.gov/climatechange/economicanalyses.html