» Executive Summary

The national debate over federal climate policy and its impact on the broader economy should be informed by the experience of the states and their stakeholders, which have been engaged in broad scale comprehensive climate policy planning, analysis and implementation since 2005. This study compiles and updates the findings of 16 comprehensive state climate action plans and extrapolates the results to the nation. The study then takes those results and using a widely accepted econometric model projects the national impact of these policies on employment, incomes, gross domestic product (GDP) and consumer energy prices. Finally, using the bottom-up data developed by the states and aggregated here, the study models the national impact of major features of the Kerry-Lieberman (K-L) bill currently under consideration in Congress.

These state action plans and supporting assessments were proposed by over 1,500 stakeholders and technical work group experts appointed by 16 governors and state legislatures to address climate, energy and economic needs through comprehensive, fact-based, consensus-driven, climate action planning processes conducted over the past five years with facilitative and technical assistance by the Center for Climate Strategies (CCS).

Findings show potential national improvements from implementation of a top set of 23 major sector-based policies and measures drawn from state plans. If implemented U.S.-wide at all levels of government, the measures yield:

- 2.5 million net new jobs in 2020 and a $159.6 billion (in 2007$) expansion in GDP in 2020;
- Over $5 billion net direct economic savings in 2020, at an average net savings of $1.57 per ton of GHG emissions avoided or removed; and
- Consumer energy price reductions of 0.56% for gasoline and oil; 0.60% for fuel oil and coal; 2.01% for electricity; and 0.87% for natural gas by 2020.

Assuming full and appropriately scaled implementation of all 23 actions in all U.S. states, the resulting greenhouse gas (GHG) reductions would surpass national GHG targets proposed by President Obama and congressional legislation, and would reduce U.S. emissions to 27% below 1990 levels in 2020, equal to 4.46 billion metric tons of carbon dioxide equivalent ($BMtCO_2e$).

The cost curve of the 23 options in Figure ES-1 shows the GHG reduction potential (horizontal axis) as well as the cost or savings (positive for cost or negative for savings dollar figures on the vertical axis). See Table ES-5 for list of the names and the specific GHG reductions and costs or savings of the 23 actions. For example, Transportation and Land Use option 1 (TLU-1) is Vehicle Purchase Incentives, Including Rebates, and Energy Supply option 1 (ES-1) is a Renewable Portfolio Standard.

Figure ES-1. Cost Curve for 23 Stakeholder-Selected Policies and Measures

Marginal Cost of U.S. 2020, Stakeholder Implementation

Source: Center for Climate Strategies, 2010.

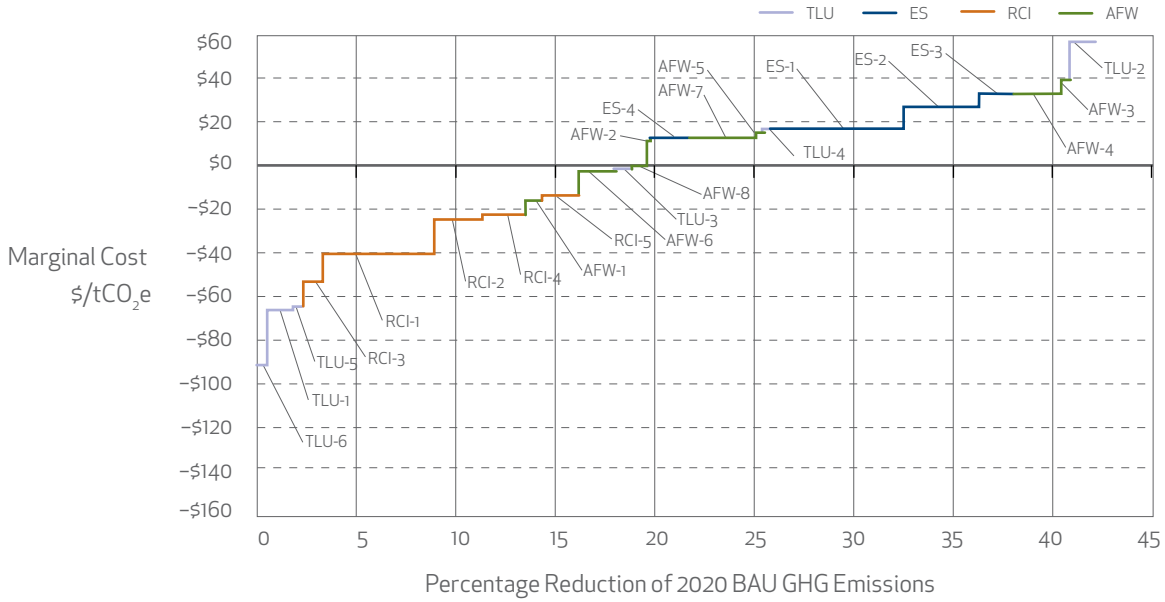


Table ES-5, below, lists the 23 policy options: TLU = Transportation & Land Use; ES = Energy Supply; AFW = Agriculture, Forestry and Waste Management; RCI = Residential, Commercial and Industrial [buildings and energy/fuel use].$/tCO2e = dollars per ton of carbon dioxide equivalent; GHG = greenhouse gas; BAU = business as usual (no action to reduce emissions).

The study also examined the effects of a cap-and-trade program as specified in the May, 2010 version of the K-L climate bill. It was assumed that about 21% of a stylized version of cap-and-trade allowances from the Electricity and Industrial sectors will be auctioned in 2020, and that about 50% of the auction revenue will be returned back to low-income consumers and the remaining revenue will be used in Highway Trust Fund and deficit reduction.

If full and appropriately scaled implementation of all 23 actions in all U.S. states, using the state stakeholders' target (27% below 1990 levels in 2020) is coupled with the K-L proposed cap-and-trade program for the Electricity and Industrial sectors, with strong revenue recycling to low-income consumers, national improvements are expected to include:

- 2.1 million net new jobs in 2020 and $116.9 billion expansion in GDP in 2020;
- Over $5 billion net economic savings in 2020, at an average of $1.57 net savings per ton GHG emissions removed;
- Consumer energy price decreases of 0.18% for gasoline, 1.74% for electricity; and 0.31% for natural gas by 2020;
- $19.2 billion in new government revenues (prior to recycling to consumers and Highway Trust Fund).

If all 23 actions are implemented at a more modest level, scaled to the recently proposed congressional targets (17% below 2005 levels in 2020, or equal to 5.98 $BMtCO_2e$), and combined with the cap-and-trade program and other K-L features described above, national improvements are expected to include:

- 0.9 million net new jobs in 2020 and $50.7 billion expansion in GDP in 2020;
- Over $6.7 billion net economic savings in 2020, at an average of $3.89 net savings per ton GHG emissions removed;
- Consumer energy price decreases of 0.02% for gasoline, 1.65% for electricity; and 0.11% for natural gas by 2020;
- $19.2 billion in new government revenues (prior to recycling to consumers and Highway Trust Fund).

This moderate implementation scenario does not perform as well economically as the full implementation scenarios because it does not provide the same level of cost-saving actions, or high employment and income stimulating actions, as the more aggressively targeted scenarios.

The 16 states on whose climate plans the work is based are: Alaska, Arkansas, Arizona, Colorado, Florida, Iowa, Maryland, Michigan, Minnesota, Montana, New Mexico, North Carolina, Pennsylvania, South Carolina, Vermont, and Washington. These were selected because they used consistent, transparent and formal procedures to develop and quantify measures, and they followed standard methodological guidelines that are peer reviewed and well accepted in practice. The selection, design, and specifications for analysis of these policy recommendations were made by stakeholders with facilitative and technical assistance by CCS.

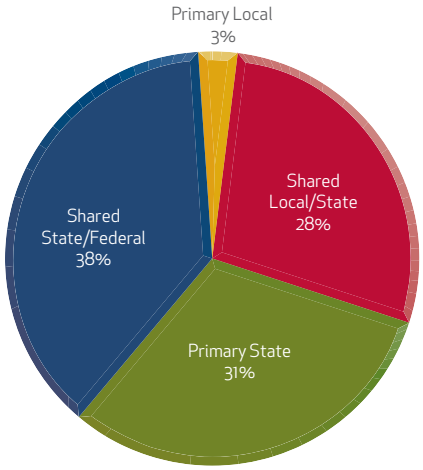
To ensure that the results are consistent and current, the 16 state climate action plans were updated to account for recent federal and state actions, the effects of the recession, and more recent fuel price projections. Policy action results for the remaining 34 states were projected to national level implementation through customized extrapolation using 37 state and sector-specific characterizing factors and a method that estimates the scaled effects of state-level implementation and performance of each of the 23 policies. (See Section 2 and Annex A.*)

Recommended actions by state climate change stakeholders included policies and measures in all sectors, at all levels of government (under a national framework), and a variety of specific matching policy instruments (including price and non price approaches) needed for achieving GHG targets, economic and energy benefits. For instance, policy tools for the 23 actions selectively include targeted funding support, tax incentives, price incentives, reform of codes and standards, technical assistance, information and education, reporting and disclosure, and voluntary or negotiated agreements.

Analysis also shows the importance of integrating local, state and federal actions, as well as policy instruments, to minimize costs and maximize co-benefits. For example, as shown in Figure ES-2:

- 38% of total potential emission reductions from these 23 options can be achieved through measures under *shared federal and state* jurisdiction;
- 31% of potential emissions reductions can be achieved through measures *primarily under state* jurisdiction;
- 31% of potential emissions reductions can be achieved through measures *primarily under local or shared local/state* jurisdiction.

Figure ES-2. State Government and Shared Responsibility for GHG Reductions
2020 Stakeholder Implementation Potential GHG Emissions Reductions by Jurisdiction
Source: Center for Climate Strategies, 2010.



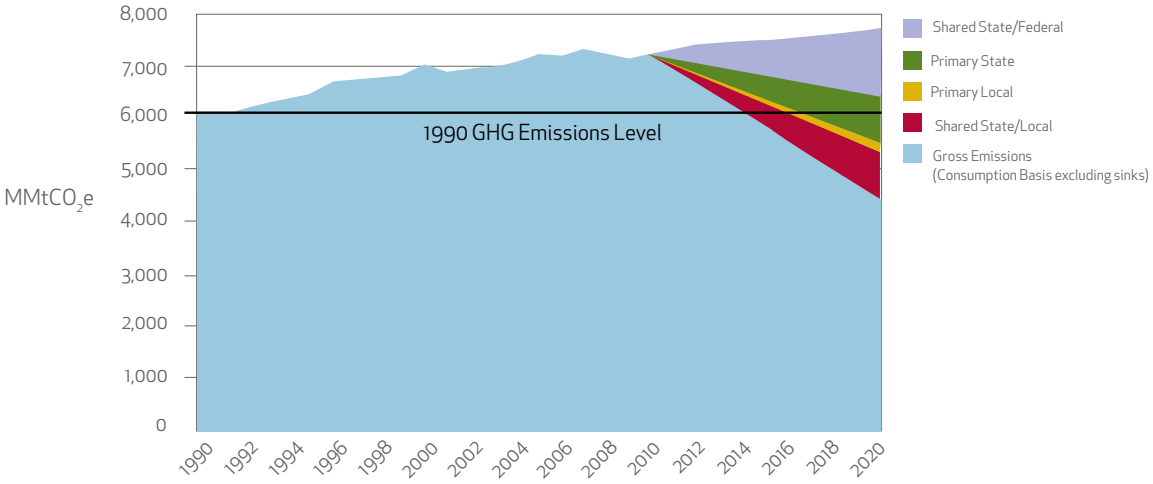
* The Annexes to this report are available at energypolicyreport.jhu.edu.

Figure ES-3 indicates the potential GHG reductions from the 23 policies and measures showing the reductions based on the levels of government with key or shared responsibility.

Figure ES-3. GHG Reduction Potential of Stakeholder Policies by Level of Government

U.S. 1990-2020 GHG Reduction Potential by Jurisdiction, Stakeholder Implementation

Source: Center for Climate Strategies, 2010.



$MMtCO_2e$ = million metric tons carbon dioxide equivalent; GHG = greenhouse gas.

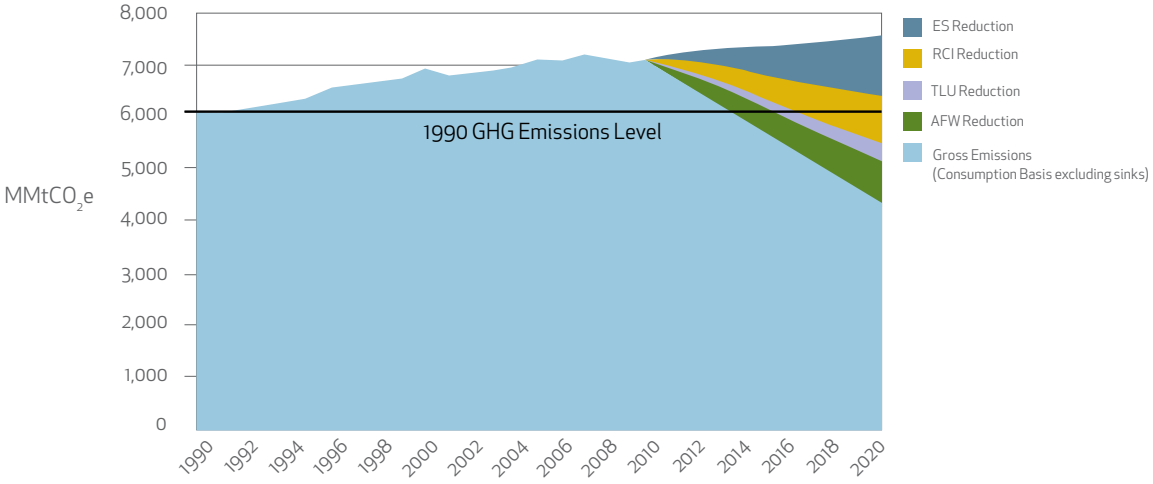
The study underscores the strategic benefits of comprehensive approaches to managing GHG emissions and the need for a national framework to support a "balanced portfolio" of actions—one that takes actions across all sectors of the economy to find the most cost effective measures. It also underscores the importance of stakeholder involvement in policy development.

Figure ES-4 shows the potential emission reductions from multiple sectors of the economy using the state stakeholders' target (27% below 1990 levels in 2020).

Figure ES-4. GHG Reduction Potential of Stakeholder Options by Sector

U.S. 2020 GHG Reduction Potential by Sector, Stakeholder Implementation (Total from Individual Options)

Source: Center for Climate Strategies, 2010.



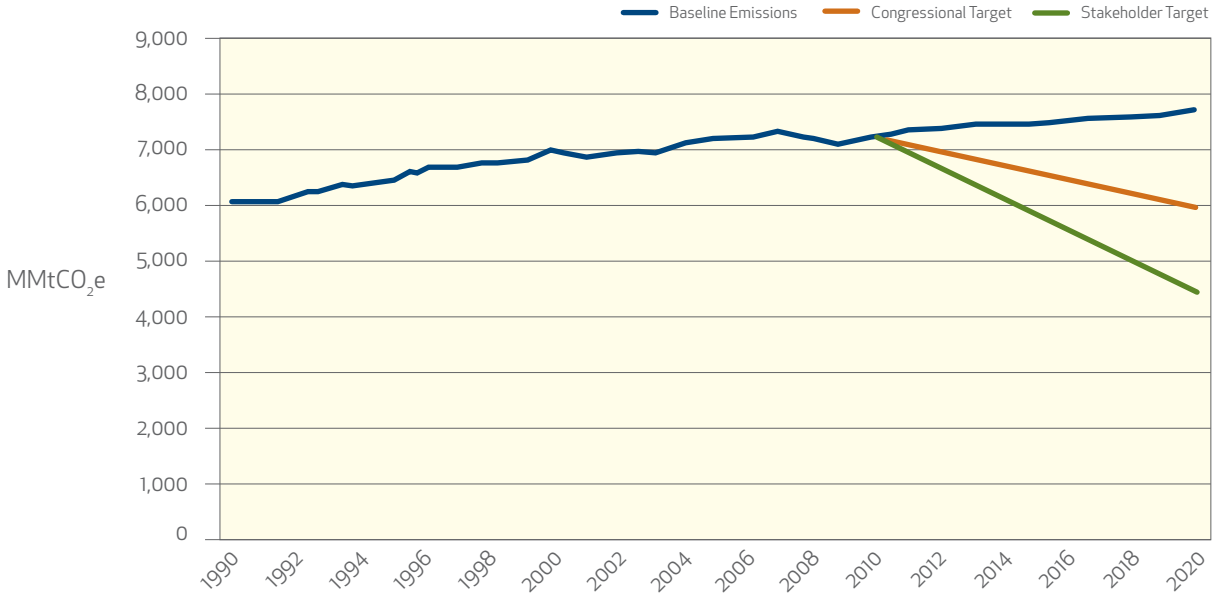
$MMtCO_2e$ = million metric tons carbon dioxide equivalent; GHG = greenhouse gas; ES = Energy Supply: RCI = Residential, Commercial and Industrial [buildings and energy/fuel use]; TLU = Transportation & Land Use; AFW = Agriculture, Forestry and Waste Management.

Figure ES-5 shows the GHG reductions expected under the stakeholder and congressional targets compared to a "business as usual" baseline in which no specific actions or programs are undertaken to curb emissions.

Figure ES-5. GHG Reductions – Stakeholder and Congressional Target Scenarios

U.S. 1990-2020 GHG Reduction Potential, Congressional Target and Stakeholder Target Scenarios

Source: Center for Climate Strategies, 2010.



GHG = greenhouse gas; $MMtCO_2e$ = million metric tons carbon dioxide equivalent.
Stakeholder Target = 27% below 1990 levels by 2020; Congressional Target = 17% below 2005 levels by 2020.

Table ES-1 summarizes the macroeconomic results of implementing the 23 state stakeholder options U.S.-wide under three scenarios. The first scenario assumes all 23 options are implemented in all 50 states at levels recommended by the stakeholders. The next two scenarios assume the 23 measures are implemented with a K-L cap-and-trade program, including recycling revenues from the program back into the economy, at the two different target levels—the state stakeholders' target and the lower congressional target. Tables ES-2 through ES-4 present the percentage change in consumer energy prices under the three scenarios projected for 2020.

Table ES-1. Summary of GHG Reductions, Directs Costs/Savings, and Macroeconomic Results

Scenario	2020 GHG Reductions ($BMtCO_2e$)[a]	2020 Direct Net Costs/Savings (billion $)[b]	2020 Net New Jobs (million $)	2020 GDP Expansion (billion $)	Total 2020 New Gov't Revenue[c] (billion $)
23 Stakeholder Policy Recommendations at Full Implementation	3.2	–$5.1	2.52	$159.6	n.a.
23 Stakeholder Policy Recommendations, Full Implementation, plus Cap-and-Trade & Revenue Recycling	3.2	–$5.1	2.13	$116.9	$19.2
23 Stakeholder Policy Recommendations at Congressional Economy-Wide Target levels, plus Cap-and-Trade & Revenue Recycling	1.7	–$6.7	0.92	$50.7	$19.2

a Reductions from estimated business-as-usual 2020 baseline emissions of 7.7 $BMtCO_2e$; $BMtCO_2e$ = billion metric tons of carbon dioxide equivalent.
b Negative numbers in this column indicate net savings.
c Direct revenues from Cap-and-Trade program allowance auction, not including use or distribution of revenues.

REMI Results on Consumer Energy Prices for Year 2020

(percentage price change from baseline level)

Table ES-2. Scenario 1: Stakeholder Target Only

Energy Source	Mitigation Activities (full implementation of the 23 super options)
Gasoline	–0.56%
Electricity	–2.01%
Natural Gas	–0.87%

Table ES-3. Scenario 2: Stakeholder Target + C&T + Revenue Recycling

Energy Source	Mitigation Activities (full implementation of the 23 super options)	Allowance Purchases from Auction	Allowance Auction Revenue Recycling	Sectoral Trading — Allowance Purchases	Sectoral Trading — Allowance Sales	International Offset Purchases	Total
Gasoline	–0.56%	0.27%	0.01%	0.06%	–0.07%	0.11%	–0.18%
Electricity	–2.01%	0.20%	0.01%	0.04%	–0.06%	0.08%	–1.74%
Natural Gas	–0.87%	0.50%	0.01%	0.04%	–0.06%	0.07%	–0.31%

Table ES-4. Scenario 3: Congressional Target + C&T + Revenue Recycling

Energy Source	Mitigation Activities (scale-back implementation of the 23 super options)	Allowance Purchases from Auction	Allowance Auction Revenue Recycling	Sectoral Trading — Allowance Purchases	Sectoral Trading — Allowance Sales	Total
Gasoline	–0.35%	0.29%	0.01%	0.15%	–0.12%	–0.02%
Electricity	–1.25%	0.21%	0.01%	0.11%	–0.73%	–1.65%
Natural Gas	–0.55%	0.60%	0.01%	0.10%	–0.27%	–0.11%

Table ES-5 presents a listing of the 23 stakeholder-selected policies showing the annual GHG reductions each is projected to achieve in 2020 if implemented nationwide. Each option's costs or cost savings and macroeconomic impacts (net employment and gross domestic product estimates) are also shown. Table ES-6 presents the same information for the 23 options combined with a cap-and-trade program, revenue recycling, and lower target embodied in the K-L legislation.

Table ES-5. Impacts of 23 Stakeholder-Recommended, Sector-Based Climate and Energy Policy Options on the U.S. Economy – Fully Implemented Stakeholder Proposals Plus Cap-and-Trade and Revenue Recycling

Sector	Climate Mitigation Actions	2020 Annual GHG Reduction ($MMtCO_2e$)	Cost or Cost Savings per Ton GHG Removed ($)	2020 Annual Cost or Cost Savings (million $)	2020 Net Employment Impact (thousands)	2020 GDP Impact (billion $)	Impact on GDP 2010–2020 NPV (billion $)
AFW–1	Crop Production Practices to Achieve GHG Benefits	65.01	–$15.69	–$1,020	87.7	$4.55	$17.50
AFW–2	Livestock Manure – Anaerobic Digestion and Methane Utilization	19.25	$11.27	$217	–0.9	–$0.17	–$0.58
AFW–3	Forest Retention	39.21	$39.38	$1,544	71.2	$0.48	$3.45
AFW–4	Reforestation/Afforestation	178.77	$33.18	$5,932	–117.8	–$11.07	–$73.47
AFW–5	Urban Forestry	39.96	$15.35	$613	505.3	$5.44	$40.12
AFW–6	MSW Source Reduction	147.09	–$3.20	–$471	25.7	$2.53	$10.37
AFW–7	Enhanced Recycling of Municipal Solid Waste	249.27	$13.39	$3,339	114.4	$10.38	$51.61
AFW–8	Landfill Gas Management	48.38	$0.34	$17	94	$10.44	$26.47
Agriculture, Forestry, Waste Management (AFW) Totals		**786.96**	**$12.92**	**$10,170**	**779.6**	**$22.58**	**$75.46**
ES–1	Renewable Portfolio Std.	508.39	$17.84	$9,071	–58.6	–$5.35	–$35.52
ES–2	Nuclear	300.77	$26.98	$8,116	–73.3	–$6.85	–$8.14
ES–3	Carbon Capture Sequestration/ Reuse	130.23	$32.92	$4,287	–35.4	–$4.47	–$16.57
ES–4	Coal Plant Efficiency Improvements and Repowering	151.05	$12.95	$1,956	1.1	$0.48	$0.86
Energy Supply (ES) Totals		**1,090.45**	**$21.49**	**$23,430**	**–166.2**	**–$16.19**	**–$59.38**
RCI–1	Demand Side Management Programs	424.80	–$40.71	–$17,293	886.2	$90.05	$305.05
RCI–2	High Performance Buildings (Private and Public)	193.88	–$24.99	–$4,845	183.3	$12.12	$40.14
RCI–3	Appliance standards	80.86	–$53.21	–$4,302	25.1	$0.05	–$0.43
RCI–4	Building Codes	161.08	–$22.86	–$3,682	181.1	$13.65	$49.05
RCI–5	Combined Heat and Power	136.37	–$13.18	–$1,798	–127.9	–$21.17	–$104.38
Residential, Commercial and Industrial (RCI) Totals		**996.98**	**–$32.02**	**–$31,920**	**1,147.80**	**$94.70**	**$289.44**
TLU–1	Vehicle Purchase Incentives, Including Rebates	103.07	–$66.37	–$6,841	179.5	$16.51	$39.64
TLU–2	Renewable Fuel Standard (Biofuels Goals)	92.34	$57.14	$5,277	–25.2	–$4.78	–$17.08
TLU–3	Smart Growth/Land Use	71.04	–$1.11	–$79	165.7	$6.15	$19.54
TLU–4	Transit	27.05	$16.72	$452	52.2	$1.18	$2.46
TLU–5	Anti–Idling Technologies and Practices	33.82	–$65.19	–$2,205	16.7	$1.92	$2.96
TLU–6	Mode Shift - Truck to Rail	36.85	–$91.56	–$3,374	40.9	$6.69	$2.92
Transportation and Land Use (TLU) Totals		**364.17**	**–$18.59**	**–$6,770**	**429.8**	**$27.68**	**$50.44**
23 Policy Totals (summation)		**3,238.57**	**–$1.57**	**–$5,090**	**2,191**	**$128.77**	**$355.97**
Stakeholder Recommendations Scenario Results (simultaneous)		**3,238.57**	**–$1.57**	**–$5,090**	**2,524**	**$159.60**	**$406.74**
Stakeholder Recommendations w/Cap & Trade + Revenue Recycling		**3,238.57**	**–$1.57**	**–$5,090**	**2,132**	**$116.90**	**n.a.**

GHG = greenhouse gas; $MMtCO_2e$ = million metric tons carbon dioxide equivalent; GDP = gross domestic product: MSW = municipal solid waste; NPV = net present value. Negative numbers indicate cost savings.
Note: The 23 Policy Totals are a simple summation of each policy's estimated results; interactions and double counting between policies have been accounted for in individual policy results; the Stakeholder Scenario simultaneous results of the REMI analysis take into account the interactive economic effects of policies.

Table ES-6. Impacts of 23 Stakeholder-Recommended, Sector-Based Climate and Energy Policy Options on the U.S. Economy – U.S. Congressional Target Plus Cap-and-Trade and Revenue Recycling

Sector	Climate Mitigation Actions	2020 Annual GHG Reduction Potential ($MMtCO_2e$)	Cost or Cost Savings per Ton GHG Removed ($)	2020 Annual Cost or Cost Savings (million $)	2020 Net Employment Impact (thousands)	2020 GDP Impact (billion $)	Impact on GDP 2010-2020 NPV (billion $)
AFW-1	Crop Production Practices to Achieve GHG Benefits	17.30	–$15.69	–$271	23.34	$1.21	$4.66
AFW-2	Livestock Manure - Anaerobic Digestion and Methane Utilization	5.12	$11.27	$58	–0.24	–$0.05	–$0.15
AFW-3	Forest Retention	10.43	$39.38	$411	18.95	$0.13	$0.91
AFW-4	Reforestation/ Afforestation	47.57	$33.18	$1,578	–31.35	–$2.95	–$19.55
AFW-5	Urban Forestry	10.63	$15.35	$163	134.46	$1.45	$10.68
AFW-6	MSW Source Reduction	39.14	–$3.20	–$125	6.84	$0.68	$2.76
AFW-7	Enhanced Recycling of Municipal Solid Waste	66.33	$13.39	$888	30.44	$2.77	$13.73
AFW-8	Landfill Gas Management	12.87	$0.34	$4	25.01	$2.78	$7.04
Agriculture, Forestry, Waste Management (AFW) Totals		**209.40**	**$12.92**	**$2,706**	**207.45**	**$6.01**	**$20.08**
ES-1	Renewable Portfolio Standard	312.93	$17.84	$5,584	–36.07	–$3.29	–$21.86
ES-2	Nuclear	185.13	$26.98	$4,995	–45.12	–$4.22	–$5.01
ES-3	Carbon Capture Sequestration/Reuse	80.16	$32.92	$2,639	–21.79	–$2.74	–$10.20
ES-4	Coal Plant Efficiency Improvements and Repowering	92.98	$12.95	$1,204	0.68	$0.30	$0.52
Energy Supply (ES) Totals		**671.20**	**$21.49**	**$14,422**	**–102.30**	**–$9.97**	**–$36.54**
RCI-1	Demand Side Management Programs	261.48	–$40.71	–$10,644	545.48	$55.43	$187.76
RCI-2	High Performance Bldgs. (Public and Private)	119.34	–$24.99	–$2,982	112.83	$7.46	$24.71
RCI-3	Appliance Standards	49.77	–$53.21	–$2,648	15.45	$0.02	–$0.26
RCI-4	Building Codes	99.15	–$22.86	–$2,266	111.47	$8.40	$30.19
RCI-5	Combined Heat and Power	83.94	–$13.18	–$1,107	–78.73	–$13.03	–$64.25
Residential, Commercial and Industrial (RCI) Totals		**613.67**	**–$32.02**	**–$19,647**	**706.50**	**$58.28**	**$178.16**
TLU-1	Vehicle Purchase Incentives, Including Rebates	63.44	–$66.37	–$4,211	110.49	$10.17	$24.40
TLU-2	Renewable Fuel Std. (Biofuels Goals)	56.84	$57.14	$3,248	–15.51	–$2.93	–$10.51
TLU-3	Smart Growth/Land Use	43.73	–$1.11	–$49	101.99	$3.79	$12.03
TLU-4	Transit	16.65	$16.72	$278	32.13	$0.72	$1.51
TLU-5	Anti-Idling Technologies and Practices	20.82	–$65.19	–$1,357	10.28	$1.19	$1.82
TLU-6	Mode Shift from Truck to Rail	22.68	–$91.56	–$2,077	25.17	$4.12	$1.79
Transportation and Land Use (TLU) Totals		**224.16**	**–$18.59**	**–$4,168**	**264.55**	**$17.04**	**$31.05**

Table ES-6, continued from previous page

Sector	Climate Mitigation Actions	2020 Annual GHG Reduction Potential ($MMtCO_2e$)	Cost or Cost Savings per Ton GHG Removed ($)	2020 Annual Cost or Cost Savings (million $)	2020 Net Employment Impact (thousands)	2020 GDP Impact (billion $)	Impact on GDP 2010-2020 NPV (billion $)
23 Policy Totals (summation)		1,718.43	-$3.89	-$6,687	1,076	$71.36	$192.74
Congressional Target Results w/o C&T + Revenue Recycling		1,718.43	-$3.89	-$6,687	1,147	$76.91	$195.50
Congressional Target Results w/Cap & Trade + Revenue Recycling		1,718.43	-$3.89	-$6,687	922	$50.73	n.a.

GHG = greenhouse gas; $MMtCO_2e$ = million metric tons carbon dioxide equivalent; GDP = gross domestic product; MSW = municipal solid waste; NPV = net present value. Negative numbers indicate cost savings.
Note: The 23 Policy Totals are a simple summation of each policy's estimated results; interactions and double counting between policies have been accounted for in individual policy results; the Stakeholder Scenario simultaneous results of the REMI analysis take into account the interactive economic effects of policies.

Key Findings

- Sector-based GHG reduction policies that are carefully selected and designed can result in net positive outcomes for employment, income, and gross domestic product, as well as reducing energy prices.
- Applying 23 major policies recommended by state-stakeholders for climate, energy, transportation, and resource actions in all 50 states, through combined federal, state and local approaches, would yield significant national economic benefits.
- Most state stakeholder-recommended climate and energy actions will have net positive impacts to the economy and employment, but some, while substantially reducing GHGs and improving energy security, will have net negative impacts without additional policy support, such as revenue recycling to low-income consumers and key industries.
- Comprehensive approaches that draw upon the best choices in all sectors, all levels of government, and all applicable policy instruments (including price and non price approaches) can attain GHG targets while minimizing costs and maximizing co-benefits (including energy and environmental security).
- In the view of stakeholders, no single policy or tool can achieve the desired GHG reductions needed to meet GHG targets and simultaneously meet economic, energy and environmental objectives in a socially and politically acceptable manner; a combined approach is needed.
- State Climate Action Plans have demonstrated that decisions on the specifics of policy design and implementation (i.e., stringency, coverage, timing), implementation tools, and other factors, can dramatically affect the economic and social performance of individual policies.
- The two most significant barriers to full implementation of climate and energy polices are adequate investment and authority at the program level.
- Federal preemption of these 23 major policies, where state and local programs are needed, could impede some of the nations' most cost-effective and job-creating actions.
- Federal, state and local jurisdictions must be partners to capture the efficiencies of comprehensive policy. The broadest jurisdictional reach rests with the states.
- Locally and regionally derived policies can be translated to action in all 50 states, but require a national framework for full implementation.

- If caps and taxes are combined with appropriate sector-based policies and measures, their cost will be significantly lower and their co-benefits will be higher than if they are implemented alone.
- Auctions of allowances in key sectors will have negative impacts on economic performance if funds are not recycled effectively. However, reinvestment to targeted support for low-income consumers and key industries can significantly reverse these impacts.
- Policy strategies applicable to the next decade must be combined with longer term policies to address future decades, and provide an important transition.