ESTIMATION OF THE INDUSTRY JOB IMPACTS OF CLIMATE CHANGE MITIGATION INITIATIVES

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For

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EXECUTIVE SUMMARY

The job impact of climate change mitigation initiatives is a critical issue, and a number of studies of the issue have been conducted -- often with differing results. Here we estimate the job impacts of The American Clean Energy and Security Act of 2009, (ACESA or Waxman-Markey) by developing three scenarios for 2020 and 2030. In addition, we analyze the impact of ACESA on employment in energy-intensive trade-exposed (EITE) industries such as steel, aluminum, glass, pulp and paper, chemicals, and oil.

ACESA would establish a cap-and-trade (C&T) system for greenhouse gases (GHG) to address climate change. The bill was approved by the House of Representatives on June 26, 2009 and represents the first time either house of Congress has approved a bill designed to reduce GHG emissions. Other key provisions of the Bill include:

- A requirement for electric utilities to meet 20 percent of their electricity demand through renewable energy and energy efficiency by 2020
- Investments in new clean energy technologies and energy efficiency, including renewable energy, carbon capture and sequestration, electric and other advanced technology vehicles, and basic scientific R&D
- Modernization of the electrical grid
- Expanded production of electric vehicles
- Mandates for significant increases in energy efficiency in buildings, home appliances, and electricity generation

Job Impacts of ACESA

We analyzed three scenarios to estimate the industry employment impacts in 2020 and 2030 of the renewable energy and energy efficiency (RE&EE) and other ACESA initiatives designed to address climate change:

- The first scenario was a reference case or “business as usual” scenario that assumed that neither the ACESA initiatives nor any other ambitious climate change mitigation programs will be implemented over the next two decades.
- The second scenario, the Basic Case, was based primarily on the RE&EE and related provisions contained in ACESA
- The third scenario, the High Technology (HT) Case was more ambitious than the second scenario and assumed that RE&EE programs are implemented that will enable the U.S. to achieve a 25 percent RPS.

For all three scenarios, industry employment impacts at the 70-order North America Industrial Classification System (NAICS) were estimated.

The major forecast parameters for the reference case scenario are summarized in Table EX-1 and Figure EX-1, which illustrate some salient U.S. economic, energy, and environmental trends for the next two decades:

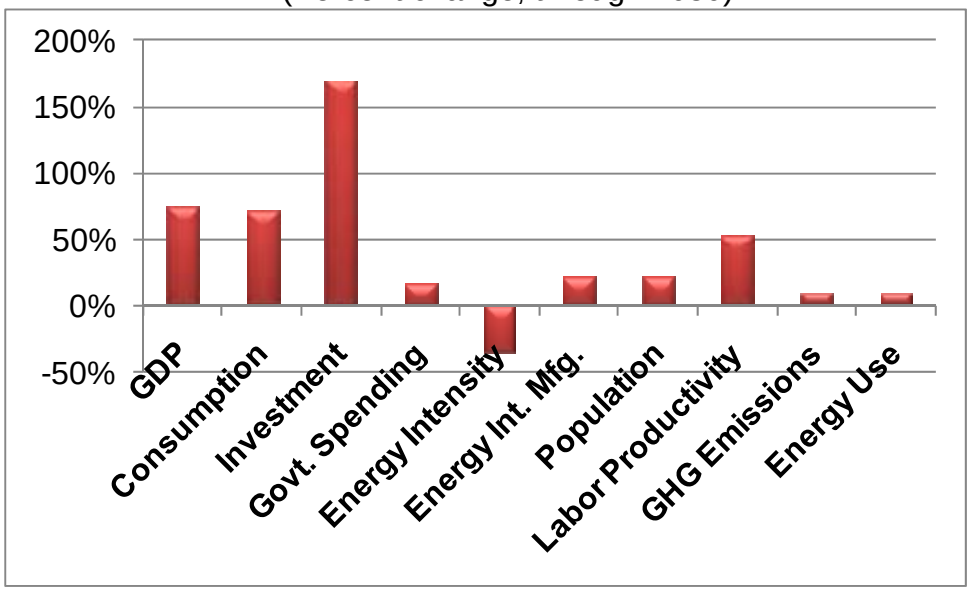
- U.S. GDP increases 75 percent, while population increases 22 percent – indicating a significant rise in per capita GDP
- Most significant, investment spending increases 170 percent
- The energy intensity of the economy decreases 35 percent, indicating that the economy will become increasingly energy efficient
- Labor productivity increases by more than 50 percent
- Both energy consumption and GHG emissions increase nine percent

Table EX-1
EIA Economic Variables for Reference and Basic Cases

	Reference Case		
	2009	**2020**	**2030**
Real GDP (billion20'00 dollars)	11,333	15,398	19,875
Real Consumption	8,163	10,817	14,069
Real Investment	1,331	2,591	3,590
Real Government Spending	2,100	2,229	2,473
Real Exports	1,378	2,862	4,865
Real Imports	1,678	2,942	4,719
Energy Intensity (thous. Btu per '00$ GDP)			
Delivered Energy	6.26	4.83	3.97
Total Energy	8.65	6.80	5.58
Population (millions)	308.4	342.6	374.7
Key Labor Indicators			
Labor Force (millions)	153.5	166.4	175.6
Nonfarm Labor Productivity (1992=1.00)	1.42	1.75	2.17

Source: Management Information Services, Inc., 2010.

Figure EX-1
Reference Case Forecasts
(Percent change, through 2030)



Source: Management Information Services, Inc., 2010.

Differences in the major macroeconomic variables among the three scenarios were found to be relatively small. For example, in the Basic and Reference cases:

- Real GDP is projected to increase an average of 2.7 percent per year over the 21 year period under both the cases, but GDP in the Basic Case will be $50 billion lower in 2030 (’00 constant dollars)
- Energy intensity is projected to decrease 2.3 percent per year under the Basic case, slightly faster than the 2.1 percent decrease in the Reference case
- Energy prices to consumers are projected to increase substantially more under the Basic case, reaching levels six percent higher in 2020 and 15 percent higher in 2030

In the HT and Reference cases:

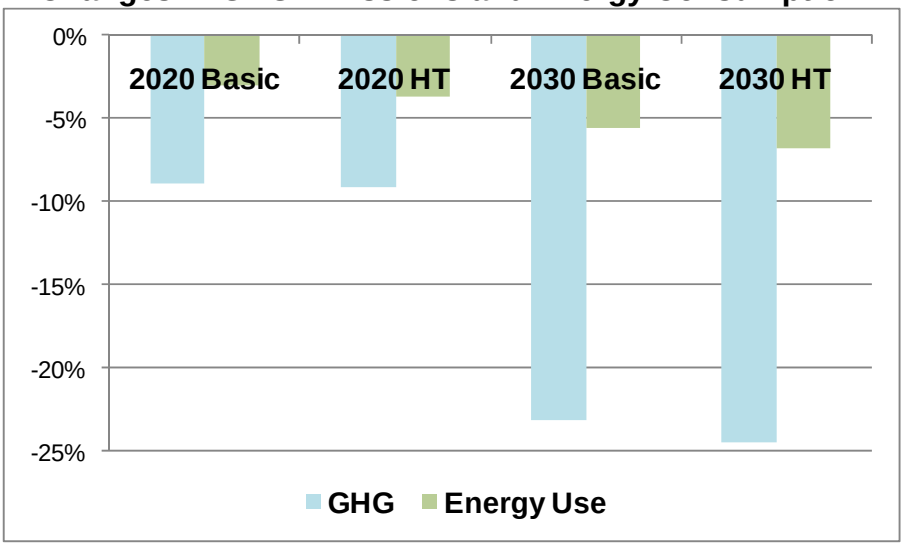
- Real GDP is projected to increase an average of 2.7 percent per year over the 21 year period under both cases, but GDP in the HT Case will be $61 billion lower by 2030 (’00 constant dollars)
- Real GDP is projected to be $9 billion higher under the High Technology Case in 2020 (’00 constant dollars) compared to the Reference Case, as most of the negative impacts to the economy occur in the second period, from 2020 to 2030
- Energy intensity is projected to decrease 2.4 percent per year under the HT Case, substantially more than the 2.1 percent decrease in the Reference case

- Energy prices to consumers are projected to increase moderately under the High Technology Case, reaching levels three percent higher in 2020 and 10 percent higher in 2030

Figure EX-2 shows changes in energy consumption and GHG emissions in 2020 and 2030 under Scenario 2, the Basic Case, and Scenario 3, the High Technology Case. This figure illustrates that compared to the reference case:

- In 2020 under Scenario 2, energy consumption decreases three percent and GHG emissions decrease 8.9 percent
- In 2020, under Scenario 3, energy consumption decreases 3.7 percent and GHG emissions decrease 9.2 percent
- In 2030 under Scenario 2, energy consumption decreases 5.6 percent and GHG emissions decrease 23 percent
- In 2030, under Scenario 3, energy consumption decreases 6.8 percent and GHG emissions decrease 25 percent

Figure EX-2
Changes in GHG Emissions and Energy Consumption



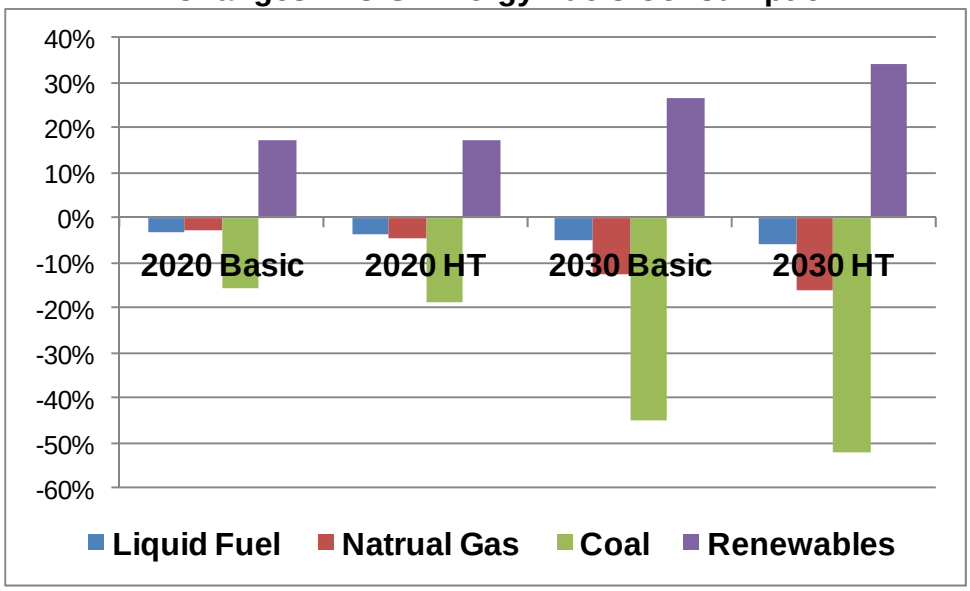
Source: Management Information Services, Inc., 2010.

Figure EX-3 shows changes in energy fuels consumption in 2020 and 2030 under Scenario 2, the Basic Case, and Scenario 3, the High Technology Case. This figure illustrates that compared to the reference case:

- In 2020, under Scenario 2 liquid fuel consumption decreases 3.1 percent and decreases 3.6 percent under Scenario 3
- In 2020, under Scenario 2 natural gas consumption decreases 2.7 percent and decreases 4.5 percent under Scenario 3
- In 2020, under Scenario 2 coal consumption decreases 16 percent and decreases 19 percent under Scenario 3

- In 2020, under Scenario 2 renewables consumption increases 17 percent and increases 17 percent under Scenario 3
- In 2030, under Scenario 2 liquid fuel consumption decreases five percent and decreases six percent under Scenario 3
- In 2030, under Scenario 2 natural gas consumption decreases 13 percent and decreases 16 percent under Scenario 3
- In 2030, under Scenario 2 coal consumption decreases 45 percent and decreases 52 percent under Scenario 3
- In 2020, under Scenario 2 renewables consumption increases 26 percent and increases 34 percent under Scenario 3

Figure EX-3
Changes in U.S. Energy Fuels Consumption



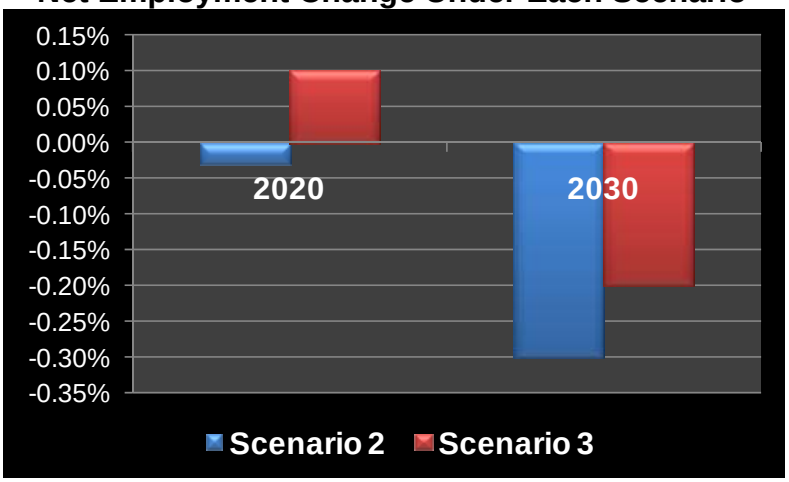
Source: Management Information Services, Inc., 2010.

Figure EX-4 indicates that net employment changes little:

- In 2020, under Scenario 2 net employment decreases 0.03 percent and increases 0.1 percent under Scenario 3
- In 2030, under Scenario 2 net employment decreases 0.3 percent and decreases 0.2 percent under Scenario 3

Further, the total net job changes of 300,000 to 600,000 are out of labor force of about 175 million.

Figure EX-4
Net Employment Change Under Each Scenario

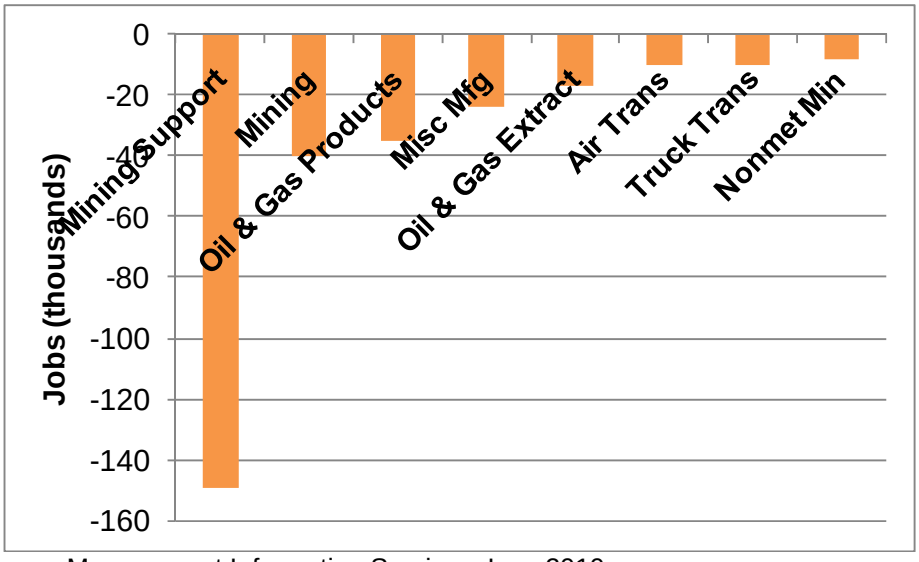


Source: Management Information Services, Inc., 2010.

Nevertheless, while the total net job losses will be very small, there will be significant job losses in some industries. For example, as shown in Figure EX-5, in 2030 under Scenario 3:

- 149,000 jobs will be lost in the Mining Support Services industry
- 40,000 jobs will be lost in the Mining industry
- 35,000 jobs will be lost in the Petroleum and Coal Products industry
- 24,000 jobs will be lost in the Miscellaneous Manufacturing industry
- 17,000 jobs will be lost in the Oil and Gas Extraction industry
- 10,000 jobs will be lost in the Air Transportation industry
- 10,000 jobs will be lost in the Truck Transportation industry

Figure EX-5
Job Losses in 2030 Under Scenario 3

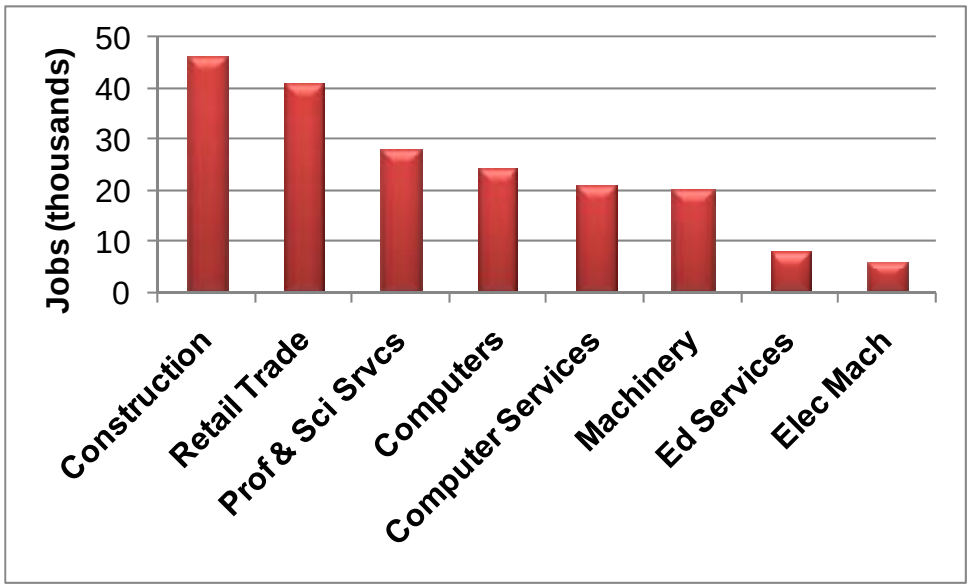


Source: Management Information Services, Inc., 2010.

Similarly, while the total net job loses will be very small, there will be significant job creation in some industries. For example, as shown in Figure EX-6, in 2020 under Scenario 3:

- 46,000 jobs will be created in the Construction industry
- 41,000 jobs will be created in the Retail Trade industry
- 28,000 jobs will be created in the Professional and Scientific Services industry
- 24,000 jobs will be created in the Computer and Electronic Products industry
- 21,000 jobs will be created in the Computer Systems Design and Related Services industry
- 20,000 jobs will be created in the Machinery industry

Figure EX-6
Job Creation in 2020 Under Scenario 3



Source: Management Information Services, Inc., 2010.

Thus, a major finding here is that, while the overall ACESA impact on net jobs will likely be very small, jobs in some industries will be lost. These industries include, depending on the scenario and year, those such as:

- Mining support activities
- Oil and gas extraction
- Chemical products
- Motor vehicles, bodies & parts
- Truck transportation

- Primary metals
- Miscellaneous transportation equipment
- Fabricated metal products
- Mining, except oil and gas
- Plastics and rubber products
- Air transportation
- Petroleum and coal products
- Electrical equipment, appliances, and components
- Nonmetallic mineral products

Similarly, while the overall ACESA impact on net jobs will likely be very small, jobs in some industries will be created. These industries include, depending on the scenario and year, those such as:

- Computer and electronic products
- Miscellaneous professional, scientific and technical services
- Information and data processing services
- Waste management and remediation services
- Retail trade
- Construction
- Rail transportation
- Water transportation
- Utilities
- Fabricated metal products
- Educational services
- Machinery
- Transit and ground passenger transportation
- Computer systems design and related services

More generally, we find that:

- Under reasonable assumptions, the total net job impact of ACESA is likely to be very small, perhaps less than 0.03 percent of the labor force
- This is true of the ACESA Basic Case (Scenario 2) and the more aggressive HT Case (Scenario 3)
- Our results are supported by findings of EIA, CBO, and EPA studies
- However, some industries – and the occupations concentrated in them – will be significantly affected, both positively and negatively
- Thus, an important finding here is that minimal total net job changes from ACESA may obscure large job losses and gains in some industries

Job Impacts of ACESA on the EITE Industries

Concerns over the potential impacts of ACESA on the competitiveness of U.S. industries induced lawmakers to include relief provisions for industries in ACESA. An EITE industry is one where its energy intensity or its GHG intensity is at least five percent and its trade intensity is at least 15 percent, and we identified 46 6-digit NAICS EITE industries. ACESA includes two provisions that address competitiveness concerns:

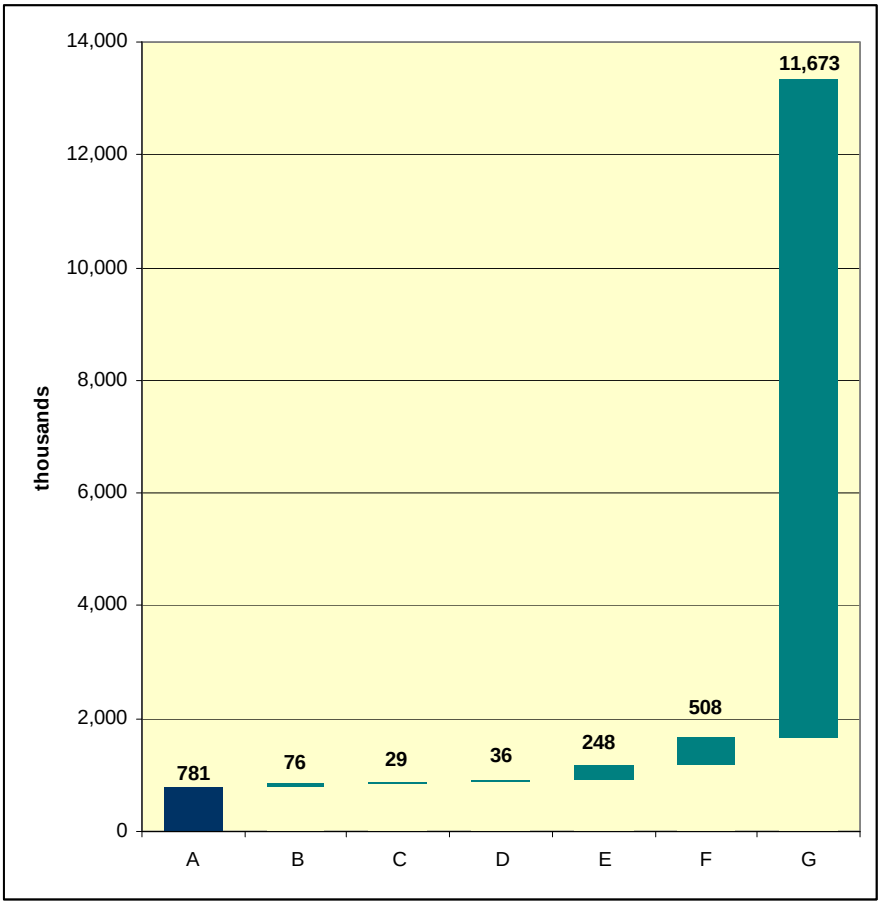
- A program for freely allocating a number of emission allowances to qualifying EITE industries
- An import allowance requirement, that would take effect in 2020, if major emitting competitors do not agree to binding commitments of their own

Figure EX-7 shows employment in all manufacturing industries, also aggregated into the "presumptively eligible" industries and into various categories of trade and energy intensity for those industries not deemed presumptively eligible. The U.S. manufacturing sector employed over 13 million people in 2007, representing about 10 percent of total nonfarm employment. This figure shows that the overwhelming majority -- nearly 95 percent -- of employees in the manufacturing sector fall outside the "presumptively eligible" industries. In fact, 88 percent of manufacturing employees work in industries with energy intensities below 2.5 percent.

EITE manufacturing represents about:

- Three percent of U.S. economic output
- Less than two percent of total employment
- Less than six percent of total direct U.S. GHG emissions

Figure EX-7
Employment in "Presumptively Eligible" Industries and in Remaining NAICS Manufacturing Industries by EITE Category - 2007



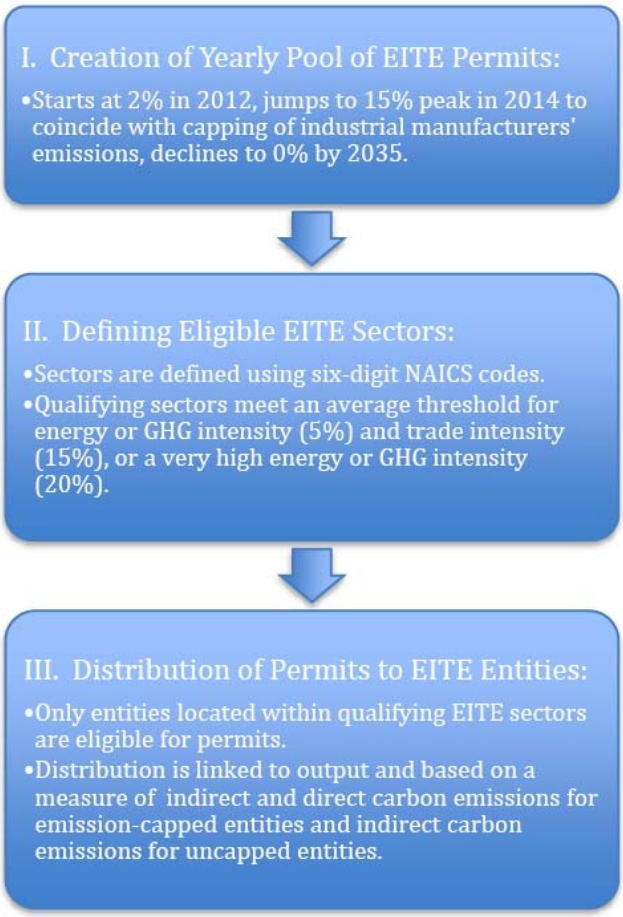
KEY:

A. Presumptively eligible industries as determined by EPA preliminary assessment
B. Other industries that meet energy intensity threshold with trade intensity between 10% and 15% or missing
C. Other industries that meet energy intensity threshold with trade intensity between 5% and 10%
D. Other industries that meet energy intensity threshold with trade intensity less than 5%
E. Other industries with energy intensity between 3.5% and 5%
F. Other industries with energy intensity between 2.5% and 3.5%
G. Other industries with energy intensity below 2.5%

Source: EPA Interagency Report, *The Effects of H.R. 2454 on International Competitiveness and Emission Leakage in Energy-Intensive Trade-Exposed Industries, December 2, 2009;* Management Information Services, Inc., 2010.

Figure EX-8 illustrates the system for allocating allowances to EITE industries.

Figure EX-8
Process for Identifying Eligible EITE Sectors and Distributing Emission Allowances to Entities Within Qualifying EITE Sectors



Source: Duke University, 2009.

Table EX-2 lists the I-O sectors and the detailed NAICS EITE industries. In almost all cases, the 2020 and 2030 employment impacts to the I-O sector are small in comparison to the 2007 employment levels. In 2020, the EITE-affected sectors will account for a loss of 12,000 jobs and in 2030 they will account for a loss of 98,000 jobs across the economy. The grey boxes in Table IV-7 denote the EITE industries where there may be as many as 1,000 jobs lost due to the ACESA.

Table EX-2
Detailed Employment Impact on Energy-Intensive Trade-Exposed Industries

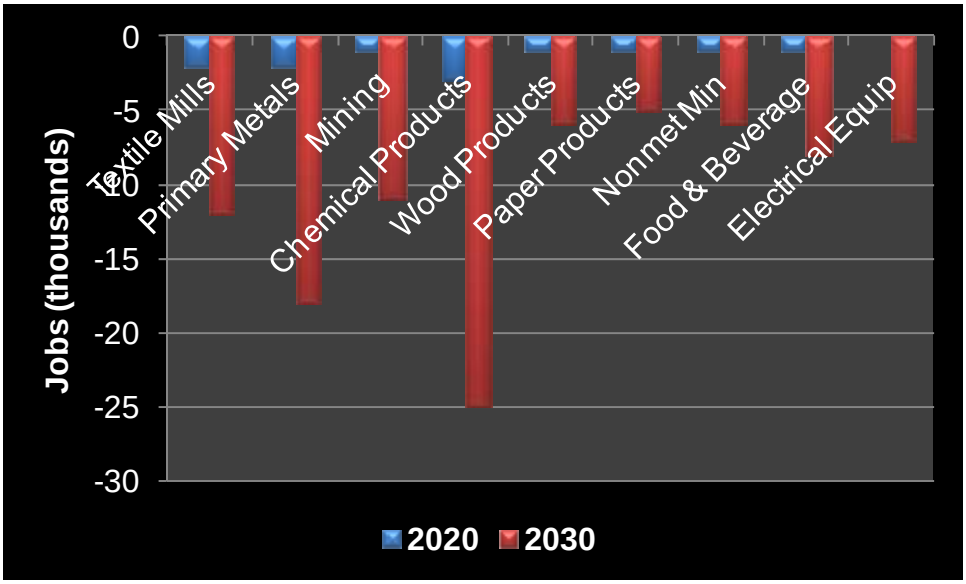
NAICS Code	I-O Sector and NAICS Title	2007 I-O Sector and NAICS Employment	2007 NAICS Employment in Sector	2020 Employment Impact (thousands)	2030 Employment Impact (thousands)
	Mining	238,000		-1	-11
212210	Iron Ore Mining	4,989	2%		
212234	Copper Ore and Nickel Ore Mining	10,384	4%		

	Food and beverage	1,843,000		-1	-8
311213	Malt manufacturing	1,022	0%		
311221	Wet Corn Milling	8,448	0%		
311613	Rendering and Meat Byproduct Processing	9,355	1%		
	Textile mills and product mills	366,000		-2	-12
313111	Yarn Spinning Mills	24,750	7%		
314992	Tire Cord and Tire Fabric Mills	3,577	1%		
	Wood products	511,000		-1	-6
321219	Reconstituted Wood Product Manufacturing	20,426	4%		
	Paper products	420,000		-1	-5
322110	Pulp Mills	7,268	2%		
322121	Paper (except Newsprint) Mills	75,921	18%		
322122	Newsprint Mills	4,917	1%		
322130	Paperboard Mills	36,641	9%		
	Chemical products	1,229,000		-3	-25
325110	Petrochemical Manufacturing	9,257	1%		
325131	Inorganic Dye and Pigment Manufacturing	7,606	1%		
325181	Alkalies and Chlorine Manufacturing (incl soda ash benif.)	6,364	1%		
325182	Carbon Black Manufacturing	1,591	0%		
325188	All Other Basic Inorganic Chemical Manufacturing	35,801	3%		
325192	Cyclic Crude and Intermediate Manufacturing	3,006	0%		
325199	All Other Basic Organic Chemical Manufacturing	70,602	6%		
325211	Plastics Material and Resin Manufacturing	71,216	6%		
325212	Synthetic Rubber Manufacturing	9,794	1%		
325221	Cellulosic Organic Fiber Manufacturing	1,353	0%		
325222	Noncellulosic Organic Fiber Manufacturing	14,684	1%		
325311	Nitrogenous Fertilizer Manufacturing	3,920	0%		
	Nonmetallic mineral products	544,000		-1	-6
327111	Vitreous China and Earthenware Plumbing Fixtures	4,825	1%		
327112	Vitreous China, Earthenware Other Pottery Manufacturing	8,774	2%		
327113	Porcelain Electrical Supply Manufacturing	4,465	1%		
327122	Ceramic Wall and Floor Tile Manufacturing	6,272	1%		
327123	Other Structural Clay Product Manufacturing	1,650	0%		
327125	Nonclay Refractory Manufacturing	5,338	1%		
327211	Flat Glass Manufacturing	10,991	2%		
327212	Other Pressed and Blown Glass Manufacturing	21,189	4%		
327213	Glass Container Manufacturing	14,928	3%		
327310	Cement Manufacturing	17,749	3%		
327410	Lime Manufacturing	4,369	1%		
327992	Ground or Treated Mineral and Earth Manufacturing	6,497	1%		
327993	Mineral Wool Manufacturing	18,891	3%		
	Primary metals	536,000		-2	-18
331111	Iron and Steel Mills	114,315	21%		
331112	Electrometallurgical Ferroalloy Product Manufacturing	2,144	0%		
331210	Iron & Steel Pipe & Tube Manufacturing from Purch. Steel	17,408	3%		
331311	Alumina Refining	1,611	0%		
331312	Primary Aluminum Production	9,355	2%		
331411	Primary Smelting and Refining of Copper	1,771	0%		
331419	Primary Smelting & Refining of Nonferrous Metal (ex. Cu & Al)	8,067	2%		
331511	Iron Foundries	51,503	10%		
	Electrical equipment, appliances, and components	484,000		0	-7
335991	Carbon and Graphite Product Manufacturing	8,666	2%		
	Total	**783,670**		**-12**	**-98**

Source: EPA Interagency Report, *The Effects of H.R. 2454 on International Competitiveness and Emission Leakage in Energy-Intensive Trade-Exposed Industries, December 2, 2009;* and Management Information Services, Inc., 2010.

Figure IV-6 summarizes the impacts on employment in select industries in 2020 and 2030. This figure illustrates that while generally small, the job losses are larger in 2030 than in 2020.

Figure IV-6
Summary of EITE Job Impacts



Source: Management Information Services, Inc., 2010.

Thus, the major findings of this research are, with respect to the jobs impact of ACESA:

- Some studies (CRA, ACCF, NAM, Heritage, etc.) contend that ACESA and climate change initiatives would cause massive job destruction – losses of 2 – 3 million jobs per year
- However, the results derived here do not support this
- We found that, under reasonable assumptions, the net job impact of ACESA is likely to be very small and may total less than 0.03 percent of the labor force
- This is true of both the ACESA Basic Case (Scenario 2) and the more aggressive HT Case (Scenario 3) which assumes a 25 percent RPS
- Our results indicating relatively small job impacts are supported by the findings of numerous studies conducted by EIA, CBO, EPA, and other organizations
- Nevertheless, some industries – and the occupations concentrated in them – will be significantly affected, both positively and negatively

- Thus, minimal total net job changes can obscure large job losses and gains in some industries

With respect to the job impact of ACESA on the EITE industries, we found that:

- Employment in the EITE industries is a small portion of both total employment and manufacturing employment, and 95 percent of manufacturing sector jobs fall outside EITE industries
- The overall effect of ACESA on EITE industries is likely to be minimal
- However, there may be several exceptions to this
- Nevertheless, in general, exogenous factors over next two decades will exceed the jobs impacts of ACESA on EITE industries

I. INTRODUCTION

BGA recognizes that climate change mitigation initiatives are necessary and that creation and retention of millions of green jobs, particularly in manufacturing and construction, must be a direct goal of climate change legislation. Such legislation is critical to jumpstarting the U.S. economy -- putting people back to work with jobs building the clean energy economy, promoting long-term economic growth, and reducing GHG emissions to avoid the worst effects of climate change. The American Recovery and Reinvestment Act of 2009 (ARRA) provided a meaningful down payment on investments in the green economy, saving or creating 3.5 million jobs, but this down payment could be wasted if the U.S. does not continue to invest in the clean energy economy at the scale necessary to convert the country to renewable energy. BGA supports legislation to create an economy-wide cap-and-trade system that accounts for international competitiveness and regional disparities and that provides a variety of mechanisms that offset rising energy costs to low- and moderate-income Americans and adversely-impacted regions of the country and mechanisms to account for global competition in energy-intensive industries.

To further these goals, BGA commissioned Management Information Services, Inc. (MISI) to conduct an industry specific study on climate change policies and effects on jobs in energy intensive industries such as steel, aluminum, glass, pulp and paper, chemicals, and oil. Part of the motivation of the study was to address claims from some industry and trade groups that climate change mitigation initiatives will destroy jobs – especially in these types of industries. This report presents the findings of the research and estimates the jobs created in these and other industries by renewable energy and energy efficiency (RE&EE). The information presented here will be useful to BGA and others in the current debate over climate change legislation in the U.S. Congress.

This project consisted of two major tasks:

- Estimation of the job creation effects and market capacity impacts of renewable energy and energy efficiency programs required to address climate change
- Analysis of the impact of Waxman-Markey on employment in energy-intensive trade-exposed (EITE) industries

Specifically, in this report:

- Chapter II summarizes previous studies of the economic and jobs impacts of climate change mitigation initiatives.
- Chapter III estimates the job impacts of renewable energy and energy efficiency programs required to address climate change.
- Chapter IV analyzes the employment effects of the energy-intensive trade-exposed industries portions of ACESA.
- Chapter V summarizes the findings derived.

II. PREVIOUS STUDIES OF THE ECONOMIC AND JOBS IMPACTS OF CLIMATE CHANGE MITIGATION INITIATIVES

Numerous studies of the economic and jobs impacts of climate change mitigation initiatives have been conducted over the past decade, and they often reached very different conclusions. The more significant of these are summarized below in three categories: 1) recent studies conducted of the impact of the American Clean Energy and Security Act of 2009 (ACESA) -- also known as Waxman-Markey, 2) recent studies of the impact of other climate change mitigation initiatives, and 3) EIA analyses of specific climate change legislation.

II.A. Recent Studies of the Impact of Waxman-Markey

American Council for Capital Formation and National Association of Manufacturers, 2009

The American Council for Capital Formation (ACCF) and the National Association of Manufacturers (NAM) contracted with SAIC to analyze ACESA, which is designed to substantially reduce U.S. GHGs over the 2012-2050 period.[1] ACCF and NAM applied input assumptions under two scenarios (high cost and low cost) that assessed the sensitivity of assumptions that have proven in the past to significantly impact the cost of limiting CO_2 emissions from energy. These input assumptions embody judgment on the likely cost and availability of new technologies in the early decades of a long-term effort to reduce GHGs as well as energy efficiency and renewable electricity standards.[2]

As summarized in Table II-1, the study's findings indicate substantial and growing impacts to consumers and the economy of meeting the increasingly stringent emission targets through 2030 established by Waxman-Markey (W-M). First, U.S. economic growth slows under W-M, especially in the post 2020 period as the free emission allowances are phased out for both energy producers and energy consumers. In 2030, the inflation adjusted, annual GDP level is reduced by 1.8 percent ($419 billion) under the low cost scenario and by 2.4 percent ($571 billion) under the high cost scenario, compared to the baseline forecast.[3] Over the entire 18 year period (2012-

[1]American Council for Capital Formation and the National Association of Manufacturers, *Analysis of the Waxman-Markey Bill "The American Clean Energy and Security Act of 2009" (H.R. 2454)*, August 2009. This study uses the NEMS/ACCF-NAM 24 model. The ACCF-NAM analysis of the Waxman-Markey bill used the most recent version of the EIA *Annual Energy Outlook*, the April AEO 2009.

[2]The assumptions include the availability of nuclear power technology for electric generation, the availability of carbon capture and storage for more efficient coal and natural gas-based power generation technologies, and the availability of wind and biomass technologies. The ACCF-NAM input assumptions also included assumptions regarding the likely availability of domestic and international offsets -- key factors influencing analysis of the cost of limiting greenhouse gas emissions.

[3]To put these GDP losses in perspective, in 2008 the Federal government spent $612 billion on social security payments to retirees. Looked at another way, if GDP levels are reduced by $571 billion in 2030, Federal and State tax receipts will be approximately $170 billion lower that year, since federal and state

2030) covered by the analysis, cumulative GDP losses are substantial, ranging from $2.2 trillion dollars under the low cost case to $3.1 trillion under the high cost case. The loss to federal and state budgets is large, and cumulative tax receipts will be reduced by between $670 billion and $930 billion compared to the baseline forecast.

Table II-1
Economic Impact of the Waxman-Markey Bill on the U.S. Economy

	Baseline (ACCF-Ref)			Low Cost Case (W/M)			High Cost Case (W/M)		
	2020	2025	2030	2020	2025	2030	2020	2025	2030
GDP (Billion 2007$)	$ 18,443	$ 21,016	$ 23,802	$ 18,403	$ 20,905	$ 23,384	$ 18,374	$ 20,853	$ 23,231
Loss in GDP (Billion 2007$)				$ 40	$ 112	$ 419	$ 68	$ 164	$ 571
% Loss				0.2%	0.5%	1.8%	0.4%	0.8%	2.4%
Employment (Millions)	157.2	160.7	165.8	157.2	160.4	164.0	157.1	160.2	163.4
Job Loss (Millions)				-0.01	0.33	1.79	0.08	0.52	2.44
% Loss				0.0%	0.2%	1.1%	0.0%	0.3%	1.5%
Industrial Output (Billion 2007$)	$ 7,962	$ 8,570	$ 8,839	$ 7,817	$ 8,305	$ 8,368	$ 7,790	$ 8,254	$ 8,263
Loss in Industrial Output (Billion 2007$)				$ 144	$ 265	$ 471	$ 172	$ 316	$ 575
% Loss				1.8%	3.1%	5.3%	2.2%	3.7%	6.5%
Coal Mining Output (Billion 2007$)	$ 27.4	$ 28.6	$ 29.2	$ 17.6	$ 12.9	$ 7.5	$ 17.0	$ 12.8	$ 7.0
Loss in Coal Mining Output (Billion 2007$)				$ 9.8	$ 15.7	$ 21.7	$ 10.4	$ 15.8	$ 22.2
% Loss				36%	55%	74%	38%	55%	76%
Primary Metals (Billion 2007$)	$ 188	$ 187	$ 164	$ 176	$ 166	$ 127	$ 171	$ 158	$ 116
Loss in Primary Metals Output (Billion 2007$)				$ 12	$ 21	$ 37	$ 17	$ 29	$ 48
% Loss				6%	11%	23%	9%	15%	29%
Carbon Allowance Price (2007$ / Ton CO2)				$ 47.50	$ 76.50	$ 123.21	$ 61.24	$ 98.63	$ 158.85
Average Household Income (2007$)	$ 98,929	$ 110,009	$ 121,731	$ 98,811	$ 109,670	$ 121,001	$ 98,679	$ 109,445	$ 120,483
Loss (2007$)				(118)	(339)	(730)	(250)	(564)	(1,248)
% Change				-0.1%	-0.3%	-0.6%	-0.3%	-0.5%	-1.0%
Energy Expenditures (Billion 2007$)	$ 1,480	$ 1,549	$ 1,682	$ 1,538	$ 1,652	$ 1,996	$ 1,584	$ 1,728	$ 2,136
Increase(2007$)				$ 57	$ 103	$ 313	$ 104	$ 179	$ 454
% change				3.9%	6.7%	18.6%	7.0%	11.6%	27.0%
Retail gasoline prices (2007 $/gallon)	$ 3.61	$ 3.69	$ 3.85	$ 3.92	$ 4.13	$ 4.62	$ 4.01	$ 4.28	$ 4.86
% Change				8.4%	12.1%	20.0%	11.1%	16.1%	26.1%
Residential Electricity Price (2007$ Cents/Kwh)	$ 11.10	$ 11.22	$ 11.69	$ 11.66	$ 11.77	$ 15.36	$ 11.98	$ 12.51	$ 17.54
% change				5.0%	4.9%	31.4%	7.9%	11.5%	50.0%
Industrial Electricity Prices (2007 Cents/Kwh	$ 6.45	$ 6.57	$ 6.91	$ 7.26	$ 7.78	$ 10.30	$ 7.84	$ 8.68	$ 12.17
% change				12.5%	18.4%	48.9%	21.5%	32.0%	76.0%
Residential Natural Gas Prices (2007$/Mcf)	$ 12.88	$ 12.93	$ 14.27	$ 12.46	$ 13.55	$ 22.31	$ 12.90	$ 14.24	$ 24.75
% change				-3.3%	4.8%	56.3%	0.1%	10.1%	73.5%
Industrial Natural Gas Prices (2007 $/Mcf)	$ 7.65	$ 7.62	$ 8.85	$ 10.19	$ 12.26	$ 16.55	$ 11.56	$ 14.19	$ 18.89
% change				33.3%	61.0%	87.1%	51.1%	86.3%	113.5%
Electric Utility Coal Prices (2007 $/Ton)	$ 38	$ 39	$ 40	$ 124	$ 180	$ 269	$ 151	$ 224	$ 345
% change				224%	359%	565%	295%	472%	755%
Manufacturing Employment (Millions)	12.0	11.6	10.1	11.8	11.2	9.5	11.7	11.1	9.4
Job Loss (Millions)				0.21	0.38	0.58	0.28	0.49	0.74
% Loss				1.8%	3.3%	5.8%	2.3%	4.2%	7.3%

Source: American Council for Capital Formation and the National Association of Manufacturers, 2009.

governments take approximately 30 cents out of every dollar of GDP. Thus, government budgets will be harder to meet.

Second, industrial production begins to decline immediately in 2012 under W-M, relative to the baseline forecast. In 2030, U.S. industrial output levels are reduced by between 5.3 percent and 6.5 percent under the low and high cost scenarios. A hallmark of economic downturns and recessions is a slowdown in the growth rate or an absolute decline in the level of industrial output. Clearly, the negative impact on industrial output of W-M would make it harder to keep the U.S. economy out of recession or prevent sluggish growth insufficient to restore job growth.

Third, employment is negatively impacted, even when additional "green" jobs are factored in. Over the 2012-2030 period, total U.S. employment averages between 420,000 and 610,000 fewer jobs each year under the low and high cost scenarios than under the baseline forecast. By 2030, there are between 1.8 and 2.4 million fewer jobs in the overall economy. Manufacturing employment is hard hit: In 2030 there are between 580,000 and 740,000 fewer jobs, or between a six and seven percent reduction in total manufacturing employment in the U.S compared to the baseline forecast. On average, over the 2012-2030 period, the manufacturing sector absorbs 59 to 66 percent of the overall job losses caused by W-M.

Fourth, energy prices rise over the 2012-2030 period, due to the various features of W-M, including prices for carbon permits, which gradually rise to between $123 and $159 dollars per ton of CO_2 by 2030 as well as the renewable portfolio standards, low carbon fuel standards, and energy efficiency standards. Over the past decade, each one percent increase in GDP in the U.S. has been accompanied by a 0.3 percent increase in energy use, thus higher energy prices will make it harder to recover from the current recession and to reduce the current high rate of unemployment. The ACCF/NAM study shows that residential electricity prices are 5 to 8 percent higher by 2020, by 2030 electricity prices are between 31 to 50 percent higher. Further, by 2030 Gasoline prices are up to 20 to 26 percent higher than under the baseline forecast.

Finally, household income drops under W-M, even after accounting for rebates to consumers mandated in the bill. In 2030, the decline in annual household income ranges from $730 in the low cost case to about $1,250 in the high cost case. However the impacts on household income in individual states, especially in the Midwest are more than 40 percent higher than the national average. For example, household income in Illinois is $1,100 lower in 2030 under the low cost case and $1,800 lower under the high cost case. Other Midwestern states, like Michigan, Indiana, and Kansas show a similar pattern, and income losses are much higher than the national average.

The ACCF/NAM analysis of the Waxman Markey bill thus shows that there are significant economic costs in terms of slower growth in jobs, household income, and GDP from meeting the bill's GHG reduction targets. The report recommends that, given the wide recognition that without strong emission cuts in developing countries like China and India, U.S. emission reductions would have only negligible environmental benefits, policymakers should proceed cautiously as they develop climate change policies. In addition, given the size of projected federal deficits and state budget receipt shortfalls,

policymakers may want to think carefully before imposing W-M bill on the already struggling U.S. economy.

National Black Chamber of Commerce, 2009

In this report the National Black Chamber of Commerce analyzed the potential economic impacts of ACESA.[4] The study examined key sections of the bill, particularly those provisions related to GHG cap-and-trade, renewable energy, and offsets, and focused on how these could affect performance of the U.S. economy.

The most important conclusion is that ACESA will have significant cost – see Table II-2. Therefore, the judgment about what action to take cannot be made simply on the grounds that a cap-and-trade program will create additional jobs and stimulate economic growth – it will not – but on whether the benefits are worth the cost. And it needs to be recognized that the benefits of any action by the U.S. alone are limited because of the relatively small share that the U.S. will contribute to global emissions over the next century.

The NBCC analysis found that businesses and consumers would face higher energy and transportation costs under ACESA, which would lead to increased costs of other goods and services throughout the economy. As the costs of goods and services rise, household disposable income and household consumption would fall. Wages and returns on investment would also fall, resulting in lower productivity growth and reduced employment opportunities. Impacts would differ across regions of the economy, depending on how local energy costs will change, whether local industries will be favored or harmed, and allocation formulas. It is not possible to avoid these costs through any free distribution of carbon allowances.

Although appropriate use of revenues from an auction or carbon tax can ameliorate impacts on some segments of the economy, the cost of bringing emissions down to levels required by the caps cannot be avoided. It is this cost of bringing down emissions that the NBCC analysis estimated, in terms of reductions in GDP and household consumption. Allocations shift who bears the burden across industries, regions, and income groups, as do decisions about how to spend or return to taxpayers the revenues from allowance auctions.

Just as it is impossible to eliminate the cost of reducing emissions to levels consistent with the cap through allocations or revenue recycling, it is impossible to bring about a net increase in labor earnings through measures that impose a net cost on the economy. NBCC found that the cap-and-trade program would lead to increases in spending on energy efficiency and renewable energy, and as a result that significant numbers of people would be employed in “green jobs.” However, estimates of jobs created in these activities are incomplete if not supplemented by estimates of the

[4]National Black Chamber of Commerce, *Impact on the Economy of the American Clean Energy and Security Act of 2009 (H.R.2454)*, report prepared by CRA International, May 2009 (updated August 2009).

reduced employment in other industries and the decline in average salaries that would result from higher energy costs and lower overall productivity in the economy.

Table II-2
Summary of Projected Economic Impacts
(change from projected baseline)

	2015	2020	2030	2040	2050
CO_2 Allowance Price (2008$/Metric Ton)	$24	$30	$49	$80	$131
Change in U.S. jobs (Millions)	-1.5	-1.8	-2.2	-3.0	-3.6
Change to Average Worker's Annual Wages: *Assumes Partial Wage Adjustment* ($2008)	-$250	-$350	-$510	-$850	-$1,250
Change in U.S. Purchasing Power ($2008 per Household)	-$760	-$810	-$880	-$990	-$1,070
Percentage Change in U.S. GDP	-0.7%	-0.8%	-1.0%	-1.3%	-1.5%
Percentage Change in Natural Gas Retail Rates*	11% ($1.30/MMBtu)	13% ($1.60/MMBtu)	17% ($2.40/MMBtu)	25% ($3.80/MMBtu)	36% ($5.70/MMBtu)
Percentage Change in Motor Fuel Cost	4% (19¢/Gallon)	5% (24¢/Gallon)	7% (38¢/Gallon)	10% (59¢/Gallon)	16% (95¢/Gallon)
Percentage Change in Electricity Retail Rates*	12% (1.3¢/ kWh)	18% (2.1¢/ kWh)	24% (2.7¢/ kWh)	41% (4.7¢/ kWh)	48% (5.8¢/ kWh)

* Percentage increases in utility bills will be smaller to the extent that there are free allowance allocations to load-serving entities and natural gas local distribution companies and/or reduced energy consumption.

Source: National Black Chamber of Commerce, 2009.

This study found that even after accounting for green jobs, there is a substantial and long-term net reduction in total labor earnings and employment. This is the unintended but predictable consequence of investing to create a "green energy future." Further, the costs estimated in this study would be much higher if it were not for the assumed use (and availability) of international offsets authorized by the bill. Specific economic impacts resulting from ACESA include the following:[5]

[5]All costs in this report are expressed in terms of 2008 dollars unless otherwise specified.

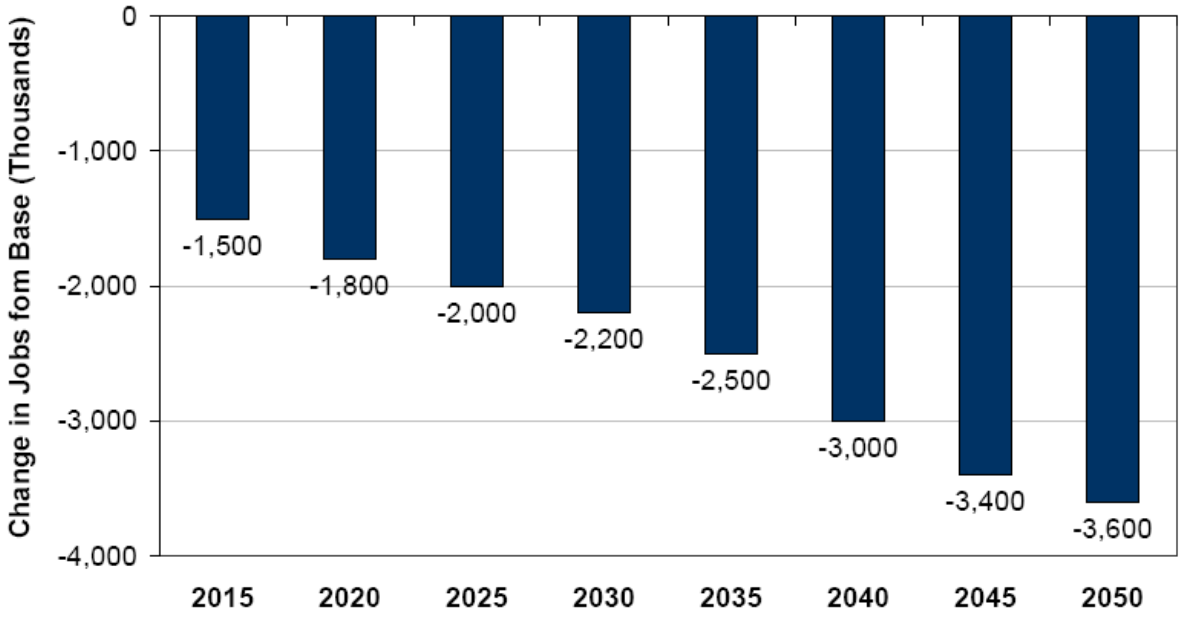
- ACESA would reduce GHG emissions through decreased use of conventional energy. As the cap progressively tightens with time, the cost of reducing emissions becomes more expensive and as a result, the cost of CO_2 allowances increases. In 2015, the cost of a CO_2 allowance is estimated to be $245.[6] For GHG emissions the relevant measure is metric tons of CO_2e. By 2030, the allowance cost could increase to $49 per metric ton of CO_2 and by 2050, the allowance cost could reach $131 per metric ton of CO_2.
- Relative to energy costs in the baseline level, retail natural gas rates would rise by an estimated 11 percent ($1.30 per MMBtu) in 2015, by 17 percent ($2.40 per MMBtu) in 2030, and by 36 percent ($5.70 per MMBtu) in 2050. Retail electricity rates are estimated to increase by 12 percent (1.3 cents per kWh) relative to baseline levels in 2015, by 24 percent (2.7 cents per kWh) in 2030 and by 48 percent (5.8 cents per kWh) in 2050.[7]
- After an estimated 19 cents per gallon increase in 2015, costs of using motor fuels are estimated to increase by 7 percent (38 cents per gallon) in 2030 and by 16 percent (95 cents per gallon) in 2050, relative to baseline levels.
- A net reduction in U.S. employment of 1.5 million job-equivalents in 2015 increasing to 2.2 million in 2030 and 3.6 million in 2050. These reductions are net of substantial gains in "green jobs." While all regions of the country would be adversely impacted, Oklahoma/ Texas, the Southeast and the Midwest regions would be disproportionately affected.
- Declines in workers' wages will become more severe with time. The earnings of an average worker who remains employed would be approximately $250 less by 2015, $510 less by 2030, and $1,250 less by 2050, relative to baseline levels.
- The average American household's annual purchasing power is estimated to decline relative to the no carbon policy case by $760 in 2015, $880 in 2030, and by $1,070 in 2050. These changes are calculated against 2010 income levels (the median U.S. household income in 2007 was approximately $50,000). They would be larger if stated against projected future baseline income levels.
- In 2015, U.S. GDP is estimated to be 0.7 percent ($110 billion) below the baseline level driven principally by declining consumption. In 2030, GDP is estimated to be roughly 1.0 percent ($250 billion) below the baseline level, and in 2050, GDP is estimated to be roughly 1.5 percent ($630 billion) below the baseline level.

[6] In this report, when carbon or CO_2 allowance prices are discussed these prices are measured as dollars per metric ton of CO_2 equivalent (CO_2e).

[7] To the extent that utilities return the value of their free allocations under ACESA to customers through reductions in fixed charges, actual total bills for electricity and natural gas will not rise as much as the rates.

Despite the promise of green jobs, ACESA would inevitably depress total employment from baseline levels. The bill would divert resources now used to produce additional goods and services into the work of obtaining energy from sources that are more costly than fossil fuels. It would, therefore, lower the sum of goods and services produced by the economy and hence the output per unit of labor. Worker compensation will decline as productivity falls. Although part of the decline in total compensation will show up as a decrease in earnings per worker, many factors inhibit decreases in average compensation. Another result of lowered productivity is likely, therefore, to appear in the form of lower employment levels. Figure II-1 illustrates the employment impacts ASCEA.

Figure II-1
Projected Changes To Employment Due To ACESA,
Assuming Partial Wage Rate Adjustments



Source: National Black Chamber of Commerce, 2009.

The actual number of jobs that would be lost depends on whether higher-paying or lower-paying jobs are the ones that are eliminated. NBCC assumed that jobs would be shed in equal proportions across the entire wage distribution, and reported the loss in "average jobs." Figure II-1 shows that in 2015, unemployment is 1.5 million higher than in the baseline. It also shows that there would remain between about 2.5 to 3.6 million fewer average jobs in the economy far into the future relative to what would otherwise have been possible. Because these estimated employment impacts are based on the general equilibrium requirement that total payments to labor must fall to the new, lower level that can be supported by the reduced overall productivity of the entire economy, they are inclusive of all increases in "green jobs" that will be created by ASCEA.

American Council for an Energy Efficient Economy, 2009

ACEEE noted that the ACESA climate and energy legislation included a number of provisions intended to help the U.S. reduce energy use through various energy efficiency measures. In particular, the bill requires utilities to obtain 20 percent of their energy through a combination of renewable energy and energy efficiency by 2020, with energy efficiency allowed to meet up to eight percent of the 20 percent goal.[8] Other energy efficiency provisions are designed to improve energy savings associated with improved building codes and retrofits, and appliance standards. The bill also facilitates energy savings within the transportation and industrial sectors.

ACEEE contends that these energy efficiency provisions have largely been overlooked in discussions and analyses of ACESA and that, when analyses ignore the readily available benefits from energy efficiency, they distort how energy and climate legislation, such as ACESA, could affect American consumers and the U.S. economy. Experience in the states that have energy efficiency programs demonstrates that efficiency is the quickest and most effective way to reduce energy usage and address climate change. This ACEEE analysis evaluated the energy efficiency provisions in ACESA and estimated that, in 2030, such provisions can:

- Save American consumers an average of $486 per household
- Create over 600,000 jobs
- Reduce carbon dioxide emissions by over 500 million metric tons (MMT)
- Avoid the need for 419 medium-sized coal-fired power plants.

The analysis also demonstrated that improving the energy efficiency provisions in ACESA by including a standalone energy efficiency resource standard (EERS) requiring 10 percent cumulative savings by 2020 (instead of the ACESA Combined Efficiency and Renewable Electricity Standard, or CERES), directing one-third of electric local distribution company allowances to energy efficiency, and sustaining State Energy and Environmental Development funding at 9.5 percent of allowance revenue through 2030 provides significant additional consumer savings and carbon reductions and creates more jobs than the original bill. ACEEE recommended incorporating these suggested improvements and estimated that, by 2030, including these improvements can:

- Save American consumers an average of $832 per household
- Create over 1 million jobs
- Reduce carbon dioxide emissions by over 900 MMT
- Avoid the need for 512 medium-sized coal-fired power plants

[8] American Council for an Energy Efficient Economy, *Energy Efficiency in the American Clean Energy and Security Act of 2009: Impacts of Current Provisions and Opportunities to Enhance the Legislation*, Washington, D.C., September 2009.

This report discussed these national-level impacts, disaggregated them to a state-by-state basis, and described the methodology for how these values were determined.

As shown in Table II-3 and Figure II-2, ACEEE estimated that ACESA's energy efficiency provisions have the potential to create between 384,000 and 513,000 net new jobs in 2020, rising to between 607,000 and 810,000 net new jobs in 2030. Under the Enhanced ACESA scenario, net new jobs in 2020 could range between 569,000 and 759,000. By 2030, the positive effects of increased energy efficiency investments are made clear with a range of between 1.03 million and 1.4 million net new jobs being created. There is a dramatic increase between jobs created in 2020 and in 2030 under the Enhanced ACESA scenario. The 2030 values are so much greater due to increased utility spending on energy efficiency programs and the extension of the SEED funding (compared to ramped-down savings under ACESA), which goes primarily to fund building retrofits and transportation planning in the enhanced case.

Table II-3
ACEEE Estimates of Benefits From Energy Efficiency in ACESA

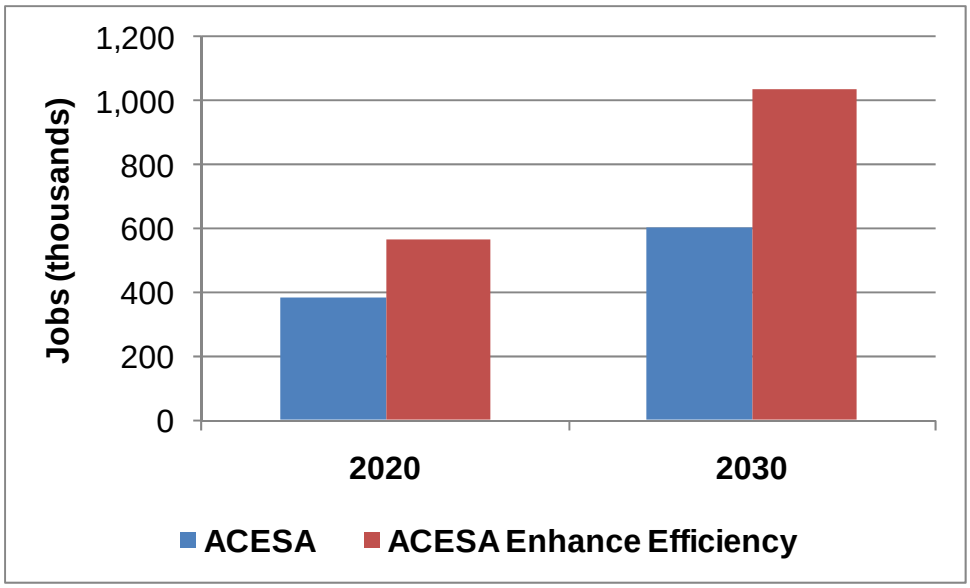
	2020		2030	
	ACESA	**Enhanced ACESA**	**ACESA**	**Enhanced ACESA**
Net jobs created (thousands)	384	569	607	1,035
Net annual consumer savings to U.S. economy (in 2007$ billion)	$30	$38	$62	$105
Net annual consumer savings per household (in 2007$ billion)	$215	$283	$486	$832
CO2 emissions avoided (MMT)	269	480	506	959
Equivalent autos taken off the road as a result of avoided CO_2 emissions, for given year (millions)	49	80	85	159
Equivalent number of 300 MW power plants avoided	253	513	419	1,023

Source: American Council for an Energy Efficient Economy, 2009.

The energy efficiency provisions in ACESA, as shown in Table III-3, produce impressive energy savings while creating significant economic benefits. These provisions would provide, on average, about $220 per household in net consumer savings in 2020. By 2030, these benefits would increase to about $490 per household, on average. The enhanced provisions to this legislation further increase the positive impacts of energy efficiency. In 2020, under the Enhanced ACESA, consumer savings are slightly higher than in the bill as passed by the House, rising to about $283 per household. However, by 2030 under the enhanced scenario, consumer savings reach over $800 per household. The net consumer savings per household from the energy

efficiency provisions would significantly exceed the projected costs associated with the legislation that result from projected energy price increases and the costs of cap and trade.

Figure II-2
Net New Jobs Created From the Energy Efficiency Provisions of ASCEA



Source: American Council for an Energy Efficient Economy, 2009.

Heritage Foundation, 2009

A May 2009 Heritage Foundation estimated the economic, energy, and job impacts of ACESA at the national level.[9] This study forecast that by 2035 the bill will:

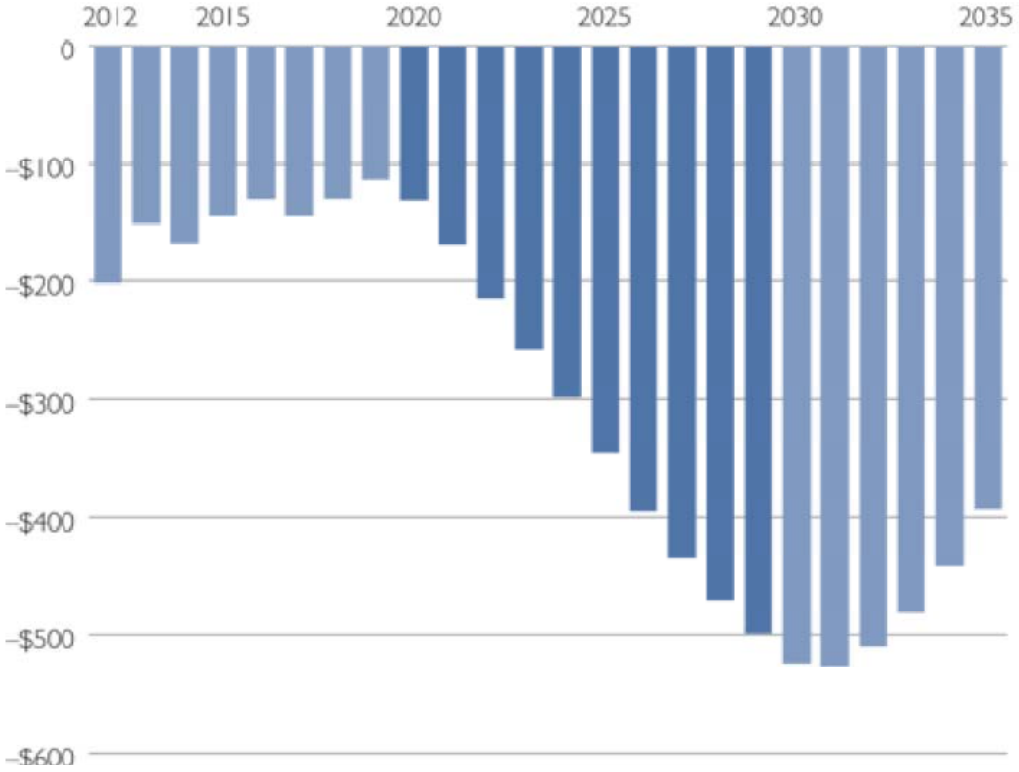
- Reduce aggregate gross domestic product (GDP) by $7.4 trillion (Figure II-3)
- Destroy 844,000 jobs on average, with peak years seeing unemployment rise by over 1,900,000 jobs
- Raise electricity rates 90 percent after adjusting for inflation
- Raise inflation-adjusted gasoline prices by 74 percent
- Raise residential natural gas prices by 55 percent
- Raise an average family's annual energy bill by $1,500
- Increase inflation-adjusted federal debt by 29 percent, or $33,400 additional federal debt per person, after adjusting for inflation

[9]William W. Beach, David Kreutzer, Karen Campbell, and Ben, Lieberman, *The Economic Impact of Waxman–Markey*, Heritage Foundation, May 2009.

Heritage found that the 2007-2009 recession diminished near-term projections for aggregate economic activity and that as this activity declines, so does energy use. The recession has the effect of moving the economy closer to the energy cuts needed to meet the emissions targets. Nevertheless, the income (GDP) losses are over $150 billion immediately and average nearly $300 billion per year. As the economy recovers and the caps tighten, the detrimental effect of cap and trade gets more and more severe. In the worst years, GDP losses exceed $500 billion per year.

Heritage determined that Waxman-Markey will cause higher energy costs to spread throughout the economy as producers try to cover their higher production costs by raising their product prices. Consumers will be most directly affected by rising energy bills and, even after adjusting for inflation, gasoline prices will rise 74 percent over the 2035 baseline price. Compared to the baseline, residential natural gas consumers will see their inflation-adjusted price rise by 55 percent. Because of its reliance on coal, the cost of electricity will rise by 90 percent after adjusting for inflation, and in addition to what the price would have been anyway in 2035.

Figure II-3
Change in GDP Due to ACESA, 2012 -2035
(billions of constant 2009 dollars)



Source: Heritage Foundation

Cap and trade can work only when energy prices "skyrocket," and to force consumer-energy cutbacks, the prices need to rise significantly. The Heritage analysis showed the results of this strategy. By 2035:

- The typical family of four will see its direct energy costs rise by over $1,500 per year.
- This causes consumers to reduce electricity consumption by 36 percent.
- Even with this cutback, the electric bill for a family of four will be $754 more that year and $12,933 more in total from 2012 to 2035.

The higher gasoline prices will have forced households to cut consumption by 15 percent, but a family of four will still pay $596 more that year and $8,000 more between 2012 and 2035. In total, for the years 2012-2035, a family of four will see its direct energy costs rise by over $24,000. These inflation-adjusted numbers do not include the indirect energy costs consumers will pay as producers are forced to raise the price of their products to reflect the higher costs of production. Nor does the $24,000 include the higher expenditure for such things as more energy-efficient cars and appliances or the disutility of driving smaller, less safe vehicles or the discomfort of using less heating and cooling.

As the economy adjusts to shrinking GDP and rising energy prices, employment decreases. On average, employment is lower by 844,000 jobs, but in some years cap and trade reduces employment by more than 1.9 million jobs.

Heritage found that the negative economic impacts accumulate, and the national debt is no exception. Waxman-Markey drives up the national debt 29 percent by 2035. This is 29 percent above what it would be without the legislation and represents an additional $33,400 per person, or more than $133,000 for a family of four. These burdens come after adjusting for inflation and are in addition to the $450,000 per family of federal debt that will accrue over this period even without cap and trade. Heritage thus concluded that the impact of Waxman-Markey on the next generation of families is thousands of dollars per year in higher energy costs, over $100,000 of additional federal debt (above and beyond the increases already scheduled), a weaker economy, and more unemployment.

U.S. Environmental Protection Agency, 2009

EPA noted that the ACESA establishes an economy wide cap and trade program and creates other incentives and standards for increasing energy efficiency and low-carbon energy. The analysis focused on the bill's cap and trade program, the energy efficiency provisions, and the competitiveness provisions.[10] Sensitivity analyses were conducted for ACESA without energy efficiency provisions, ACESA without rebates,

[10]U.S. Environmental Protection Agency, Office of Atmospheric Programs, *EPA Analysis of the American Clean Energy and Security Act of 2009 H.R. 2454 in the 111th Congress*, June 23, 2009.

ACESA with reference level nuclear, and ACESA with no international offsets.[11] EPA's major findings included:

- ACESA transforms energy production and consumption: Increased energy efficiency and reduced energy demand mean that energy consumption levels that would be reached in 2015 without the policy are not reached until 2040 with the policy.
- The share of low- or zero-carbon primary energy (nuclear, renewables, and CCS) rises substantially under the policy to 18 percent of primary energy by 2020, 26 percent by 2030, and 38 percent by 2050, whereas without the policy the share would remain steady at 14 percent. Increased energy efficiency and reduced energy demand reduces primary energy needs by 7 percent in 2020, 10 percent in 2030, and 12 percent in 2050.
- Offsets and electric power supply and use represent the largest sources of emissions abatement.
- Across all scenarios modeled without constraints on international offsets, the allowance price ranges from \$13 to \$15/tCO_2e in 2015 and from \$16 to \$19/tCO_2e in 2020.
- Across all scenarios modeled that vary constraints on international offsets, the allowance price ranges from \$13 to \$24/tCO_2e in 2015 and from \$16 to \$30/tCO_2e in 2020.
- Offsets have a strong impact on cost containment, and the annual limit on domestic offsets is never reached.
- While the limits on the usage of international offsets (accounting for the extra international offsets allowed when the domestic limit is not met) are not reached, usage of international offsets averages over 1 billion tCO_2e each year.
- Without international offsets, the allowance price would increase 89 percent relative to the core policy scenario.
- The cap and trade policy has a relatively modest impact on U.S. consumers, assuming the bulk of revenues from the program are returned to households. Average household consumption is reduced by 0.03-0.08 percent in 2015, 0.10-0.11 percent in 2020, and 0.31-0.30 percent in 2030, relative to the no policy case.[12]
- Average household consumption will increase by 8-10 percent between 2010 and 2015 and 15-19 percent between 2010 and 2020 in the ACESA scenario.
- In comparison to the baseline, the 5 and 10 year average household consumption growth under the policy is only 0.1 percentage points lower for 2015 and 2020.

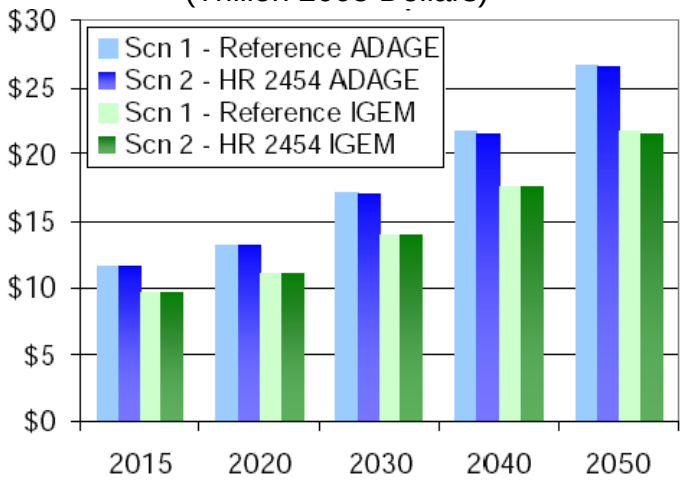
[11]Several provisions outside of the cap and trade program were not modeled in this analysis (e.g. lighting standards are not in the analysis, and the renewable electricity standard is not included in economy-wide modeling but is modeled as a sensitivity in power sector analysis).

[12]Annual net present value cost per household (at a discount rate of 5 percent) averaged over 2010-2050 under the core scenario.

- Average annual household consumption is estimated to decline by $80 to $111 dollars per year relative to the no policy case, which represents 0.1 to 0.2 percent of household consumption.
- These costs include the effects of higher energy prices, price changes for other goods and services, impacts on wages, and returns to capital, but do not account for the benefits of avoiding the effects of climate change.
- A policy that failed to return revenues from the program to consumers would lead to larger losses in consumption.

While this EPA analysis contained a set of scenarios that cover some of the important uncertainties involved in modeling the economic impacts of a comprehensive climate policy, there are still remaining uncertainties that could significantly affect the results. EPA's major economic findings are summarized in Figure II-4.

Figure II-4
U.S. Consumption
(Trillion 2005 Dollars)



Source: U.S. Environmental Protection Agency, 2009

U.S. Congressional Budget Office, 2009

CBO analyzed ACESA, as reported by the House Committee on Energy and Commerce on May 21, 2009, which would create a cap-and-trade program for GHG emissions.[13] It examined the average cost per household that would result from

[13]U.S. Congressional Budget Office, *The Estimated Costs to Households From the Cap-and-Trade Provisions of H.R. 2454*, June 19, 2009.

implementing the GHG cap-and-trade program under ACESA, as well as how that cost would be spread among households with different levels of income.[14]

Reducing emissions to the level required by the cap would be accomplished mainly by reducing demand for carbon-based energy by increasing its price. Those higher prices would reduce households' purchasing power, but the distribution of emission allowances would improve households' financial situation. The net financial impact of the program on households in different income brackets would depend in large part on how many allowances were sold, how the free allowances were allocated, and how any proceeds from selling allowances were used. The net impact would reflect both the added costs that households experienced because of higher prices and the share of the allowance value that they received in the form of benefit payments, rebates, tax decreases or credits, wages, and returns on their investments.

CBO estimated that the net annual economy-wide cost of the cap-and-trade program in 2020 would be $22 billion -- about $175 per household. That figure includes the cost of restructuring the production and use of energy and of payments made to foreign entities under the program, but it does not include the economic benefits and other benefits of the reduction in GHG emissions. Households in the lowest income quintile would see an average net benefit of about $40 in 2020, while households in the highest income quintile would see a net cost of $245. Added costs for households in the second lowest quintile would be about $40 that year; in the middle quintile, about $235; and in the fourth quintile, about $340. Overall net costs would average 0.2 percent of households' after-tax income.

Gross compliance costs would consist of the cost of emission allowances, the cost of both domestic and international offset credits, and the resource costs incurred to reduce the use of fossil fuels:

- The cost of the allowances. The cost of acquiring allowances would become a cost of doing business. In most cases, firms required to hold the allowances would not bear that cost; rather, they would pass it onto their customers in the form of higher prices.
- The cost of both domestic and international offset credits. Like the cost for allowances, the cost of acquiring offset credits would be passed on by firms to their customers in the form of higher prices.
- The resource costs associated with reducing emissions. The resource costs would include the value of the additional resources required to reduce emissions, by making improvements in energy efficiency, or by changing behavior to save energy.

[14]The analysis did not include the effects of other aspects of the bill, such as federal efforts to speed the development of new technologies and to increase energy efficiency by specifying standards or subsidizing energy-saving investments.

According to CBO's estimates, the gross cost of complying with the GHG cap-and-trade program would be about $110 billion in 2020 (measured in terms of 2010 levels of consumption and income), or about $890 per household. Of that gross cost, 96 percent would be the cost of acquiring allowances or offset credits. The reminder would be the resource costs associated with reducing emissions.

Although households and governments would pay for the cost of the allowances in the form of higher prices, those allowances would have value and would be a source of income. The ultimate effects of the cap-and trade program on U.S. households would depend on policymakers' decisions about how to allocate that value. Allowances would be allocated among businesses, households, and governments, and the value of those allowances would ultimately be conveyed to households in various ways:

- About 30 percent of the allowance value -- $28 billion -- would be allocated in a fairly direct manner to U.S. households to compensate them for their increased expenditures.
- Roughly 50 percent of the allowance value -- $47 billion -- would be directed to U.S. businesses to offset their increased costs.
- About 10 percent of the allowance value would be allocated to the federal government and to state governments.
- Finally, ACESA would direct the federal government to spend 7 percent of the allowance value overseas, funding efforts to prevent deforestation in developing countries, to encourage the adoption of more efficient technologies, and to assist developing countries.

Taking into the account the costs of complying with the cap ($110 billion), the allowance value that would flow back to U.S. households ($85 billion), and the additional transfers and costs discussed above (providing net benefits of $2.7 billion), the net economy-wide cost of the GHG cap-and-trade program would be about $22 billion, about $175 per household -- Table II-4. Four factors account for that net cost:

- The purchase of international offset credits ($8 billion)
- The cost of producing domestic offset credits ($3 billion)
- The resource costs associated with reducing emissions ($5 billion)
- The allowance value that would be directed overseas ($6 billion)

Each of those components represents costs that would be incurred by U.S. households as a result of the cap-and-trade program but would not be offset by income resulting from the value of the allowances or from additional payments (such as increases in Social Security benefits) that would be triggered by the program. Estimates of the average net cost to households under ACESA do not reveal the wide range of effects that the cap-and-trade program would have on households in different income brackets, different sectors of the economy, and different regions of the country. In order to provide greater insight into some of those variations, CBO estimated the effect of the GHG cap-and-trade program on the average household in each fifth (quintile) of the population arrayed by income.

CBO estimated that households in the lowest income quintile would see an average net benefit of about $40, while households in the highest income quintile would see a net cost of approximately $245. Households in the second lowest quintile would see added costs of about $40 on average, those in the middle quintile would see an increase in costs of about $235, and those in the fourth quintile would pay about an additional $340 per year. Overall, costs for households would average 0.2 percent of their average after-tax income.

Table II-4
Total Cost and Average Cost of the GHG Cap-and-Trade Program in ACESA

	Total Cost (Billions of dollars)	Share of Allowance Value (Percent)	Average Cost per Household (Dollars)
Gross Costs of Complying with the Cap			
Cost of Allowances and Offsets			
Market Value of Allowances	91.4	100.0	740
Domestic and International Offsets	13.3	n.a.	110
Resource Costs	4.9	n.a.	40
Total Gross Cost	109.6	n.a.	890
Disposition of Allowance Value to Domestic Entities			
Allocation of Allowances to Households			
Low-income rebate and tax credit	-13.7	15.0	-110
LDC residential customers	-14.5	15.8	-115
Allocation of Allowances to Businesses			
Trade-exposed industries	-14.1	15.4	-115
LDC nonresidential customers	-27.1	29.7	-220
Other	-5.5	6.0	-45
Allocation of Allowances to Government			
Deficit reduction	-1.0	1.1	-10
Energy efficiency and clean energy technology	-6.9	7.5	-55
Other public purposes	-2.3	2.5	-20
Total	-85.0	93.0	-690
Other Transfers			
Low-Income Rebate and Tax Credit Not Covered by Allowance Allocation	-2.8	n.a.	-25
Automatic Indexing of Taxes and Transfers	-8.7	n.a.	-70
Net Income to Providers of Domestic Offsets	-2.7	n.a.	-20
Total	-14.3	n.a.	-115
Additional Government Costs			
Low-Income Rebate and Tax Credit Not Covered by Allowance Allocation	2.8	n.a.	25
Automatic Indexing of Taxes and Transfers	8.7	n.a.	70
Total	11.6	n.a.	95
Net Economywide Cost	21.9		175
Memorandum: Source of Net Economywide Cost			
International offsets	7.8	n.a.	65
Production cost of domestic offsets	2.7	n.a.	20
Resource costs	4.9	n.a.	40
Allowance value going overseas	6.4	7.0	50
Total	21.9	n.a.	175

Source: U.S. Congressional Budget Office, 2009.

The Brookings Institution, 2009

This 2009 report from the Brookings Institution estimated that Waxman-Markey (WM) would have severe impacts on the U.S. economy.[15] These include (prices and costs in 2008 dollars):

- An annual U.S. GDP decrease of about 1.75 percent in 2030. Based on EIA forecasts, this indicates that WM will reduce U.S. GDP in 2030 by about $430 billion -- a loss of about $3,100 per U.S. household per year – and things get worse after 2030.
- By 2018, WM would cause the loss of about 700,000 jobs.
- Inflation would be 4-5 percent higher over the next two decades.
- The impact on the coal industry would be devastating: By 2025, the cost of coal would more than double, increasing 110 percent; coal production in 2025 would be 40 percent lower, and by 2025, employment in the coal sector would decline by 50 percent.
- The petroleum sector would also be severely affected: By 2025, crude oil costs would increase 40 percent; crude oil production in 2025 would decline by more than 40 percent, and by 2025, jobs in the crude oil sector would decline by nearly 40 percent.
- CO_2 prices would increase continuously: $45/ton in 2020, $80/ton in 2030, $100/ton in 2040, and more than $120/ton in 2020.
- Allowance values increase rapidly, reaching over $320 billion per year by 2025
- Finally, over the next four decades, WM would result in a wealth transfer via allowances of $9.2 trillion.

The authors noted that the U.S. Congress continues to debate a potential cap-and-trade program for the control of GHG emissions. The economic effects of such a bill remain in dispute, with some arguing that a cap-and-trade program would create jobs and improve economic growth and others arguing that the program would shift jobs overseas and hit households with large energy price increases.

Brookings used a global economic model to evaluate different emission reduction paths and to develop insights for policymakers about how to the design the C&T program to lower the costs of achieving long-run environmental goals. The study examined GHG emissions reduction paths that are broadly consistent with proposals by President Obama and with Waxman-Markey, and also evaluated two cost minimizing paths that reach similar goals. The study estimated that alternative paths to reach an emission reduction target of 83 percent below 2005 levels by 2050:

- Reduce cumulative U.S. emissions by 38 percent to 49 percent, about 110 to 140 billion metric tons CO_2

[15]The Brookings Institution, *Consequences of Cap and Trade*, June 2009.

- Reduce personal consumption by 0.3 percent to 0.5 percent -- about $1 to $2 trillion in discounted present value, 2010 to 2050
- Reduce the level of U.S. GDP by around 2.5 percent relative to what it otherwise would have been in 2050
- Reduce employment levels by 0.5 percent in the first decade, with large differences across sectors
- Create an annual value of emission allowances of over $300 billion by 2030, and a total value of over $9 trillion, 2012 - 2050

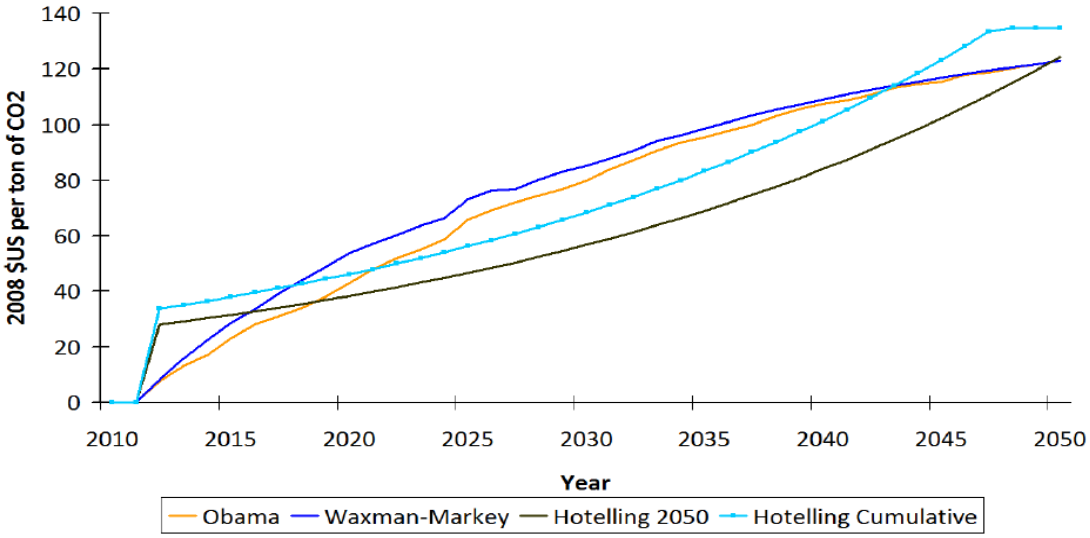
The authors examined four scenarios:

- Obama – GHG emissions 14 percent lower by 2020
- Waxman Markey -- GHG emissions 20 percent lower by 2020 and 40 percent lower by 2030
- Hotelling 2050 -- Least cost path to 83 percent reduction by 2050
- Hotelling Cumulative -- least cost path with the same cumulative emissions as Obama

The major findings are illustrated in Figures III-4 through III-8

Carbon prices would increase continuously, from $45/ton in 2020 to more than $120/ton by 2050 – Figure II-5.

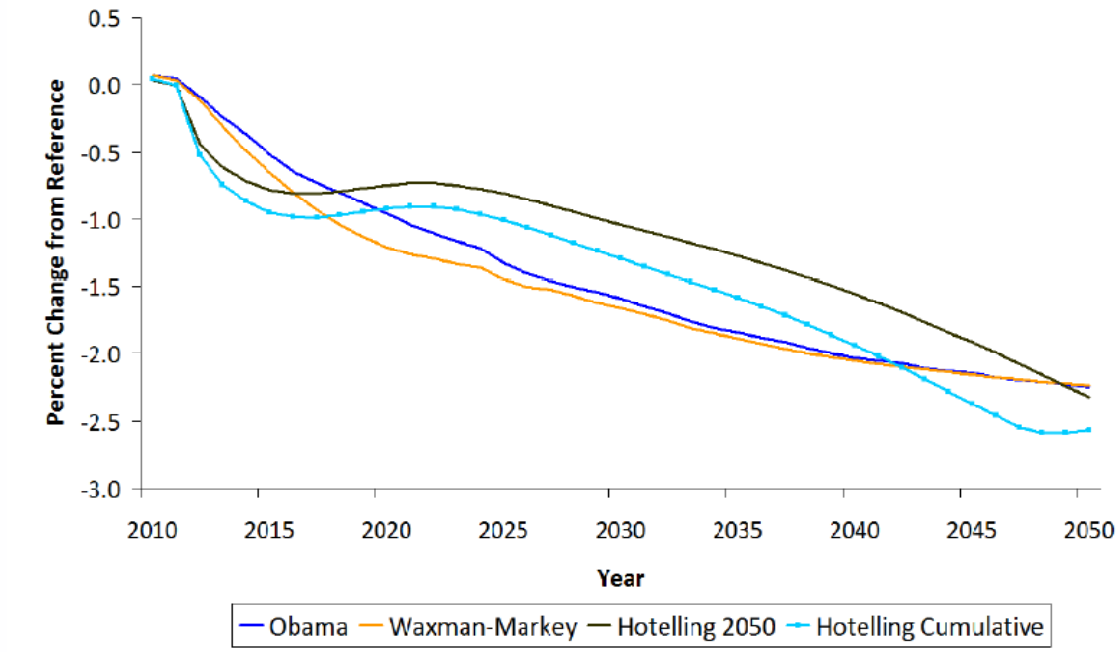
Figure II-5
Carbon Prices Under Alternative Policies



Source: The Brookings Institution, 2009

U.S. GDP would decline continuously – Figure II-6.

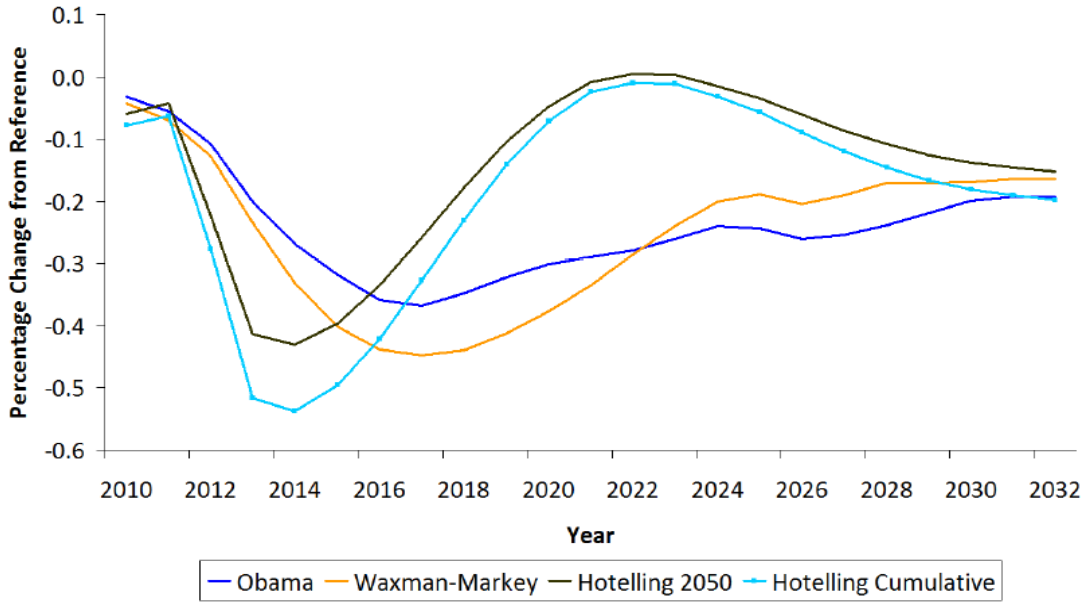
Figure II-6
Effect of Alternative Policies on US GDP



Source: The Brookings Institution, 2009

Total employment would be reduced – Figure II-7.

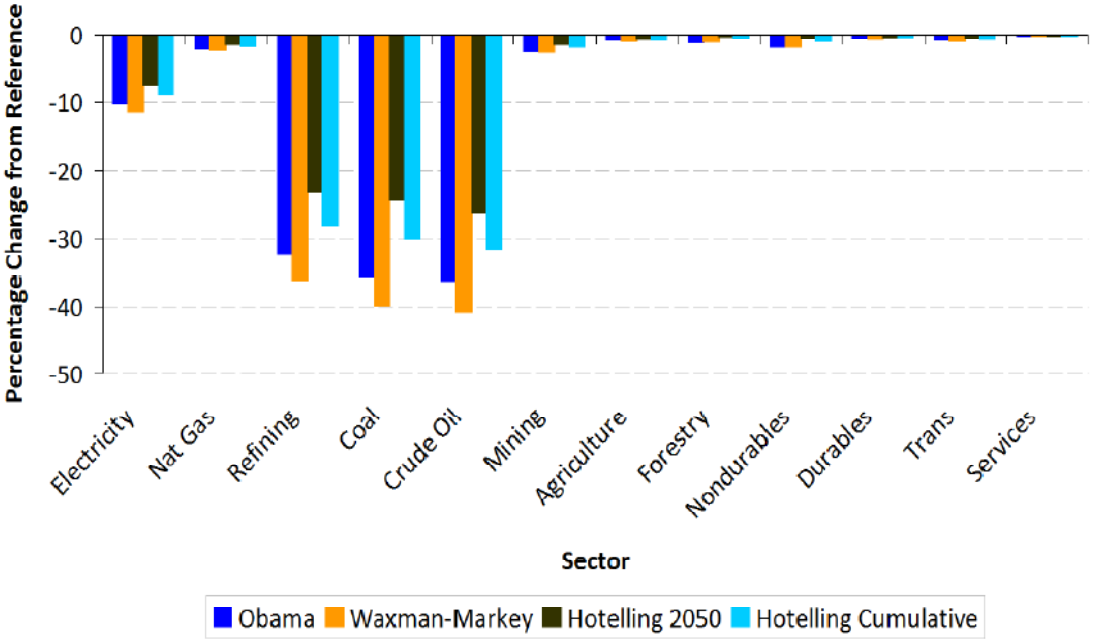
Figure II-7
Effect of Alternative Policies on US Employment



Source: The Brookings Institution, 2009

The U.S. coal and petroleum sectors would be devastated – Figure II-8.

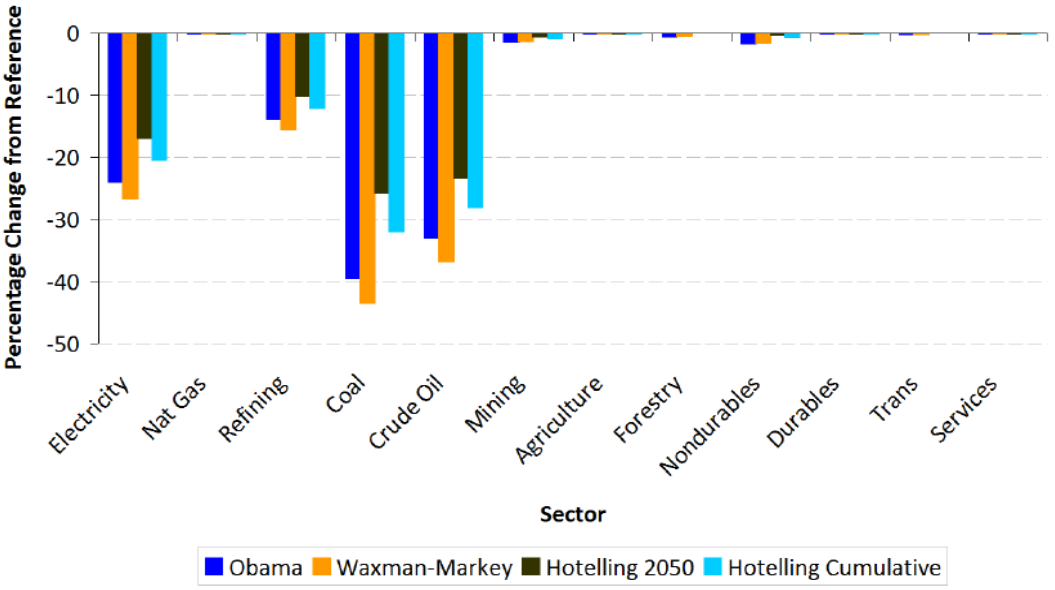
Figure II-8
Effect on Production in 2025



Source: The Brookings Institution, 2009

Employment in the U.S. domestic coal and petroleum sectors would decline drastically – Figure II-9.

Figure II-9
Effect on Employment in 2025



Source: The Brookings Institution, 2009

II.B. Studies of the Impact of Climate Change Mitigation Initiatives

Political Economy Research Institute, 2010

This study examined the economic impacts of the Carbon Limits and Energy for America's Renewal (CLEAR) Act, focusing on household incomes and job creation across the states.[16] The CLEAR Act would place a cap on the use of fossil fuels so as to reduce emissions of carbon dioxide. Any policy that limits the use of fossil fuels will raise their price, impacting real family incomes; however, the net impact on family incomes depends on who gets the money that is paid by consumers as a result of higher fuel prices. The CLEAR Act recycles 75 percent of this money to the public in the form of equal monthly dividends, and devotes the remaining 25 percent to clean energy investments. Dividends will insulate household incomes from the impact of higher fossil fuel prices, and expenditures from the Clean Energy Reinvestment Trust (CERT) Fund will create jobs in energy efficiency and renewable energy.

Dividends are the same for all, so the net impact on family incomes (dividends minus the impact of carbon prices) will vary among households depending on the amount of fossil fuels they consume directly and indirectly. Families who consume more will have lower net benefits; families who consume less will have higher net benefits. But regardless of their consumption level, all will have an incentive to limit their use of fossil fuels in response to the market price signals resulting from the cap.

Because high-income households generally consume more fossil fuels than low-income and middle-income households, they will tend to pay more as a result of higher fuel prices than they receive as dividends. These income-related differences in net impacts also apply at the level of interstate comparisons: All else equal, states with lower per capita incomes will receive higher net benefits from the CLEAR Act dividends than states with higher per capita incomes. But states also differ in other ways that will affect net impacts, such as the carbon intensity of their electricity supplies. At any given income, families in states that get most of their electricity from coal-fired plants will face bigger price increases than families in states that get most of their electricity from less carbon-intensive sources. This effect is offset to some extent, however, insofar as more coal-intensive states tend to have lower average incomes.

This report found that interstate differences in impacts on household incomes are small -- much smaller than differences across the income spectrum, and vastly smaller than the differences in other federal programs, such as defense spending. As a result, the authors concluded that the CLEAR Act would deliver positive net benefits to the median household -- and to the majority of households -- in each state. Nevertheless, interstate differences may be of concern to policy makers. If so, the report suggested that there are two ways to address these concerns: (i) by adjusting dividends in the initial years of the policy, by providing state specific dividends that equalize net impacts

[16] James K. Boyce and Matthew E. Riddle, *Clear Economics: State-Level Impacts of the Carbon Limits and Energy For America's Renewal Act on Family Incomes and Jobs*, Department of Economics and Political Economy Research Institute, University of Massachusetts, Amherst, March 2010.

on the median household in each state; or (ii) by allocating investments under the CERT Fund so as to offset these interstate differences.

Interstate differences could be eliminated altogether by modifying the Act so as to provide state-specific dividends, calibrated to equalize net impacts on median households across the states. To avoid creating perverse long-term incentives for states to rely on fissil energy, these dividends could converge towards the national average over time. Under this approach, the authors estimated that, initially, 66 percent of total carbon revenue would go to a base dividend received by residents in every state, and nine percent to dividend supplements that vary based on the impact of higher fossil fuel prices on median households.

Alternatively, interstate differences could be addressed in the allocation of the CERT Fund, by directing more investment to states with higher unemployment and/or greater potential economic dislocations from the shift away from fossil fuels. The report estimated that the CERT Fund will create about 360,000 jobs nationwide. This estimate only counts jobs created by public expenditure; it does not count net job creation from shifting private expenditure away from fossil fuels and towards more labor intensive spending on energy efficiency and renewable energy. The authors noted that an advantage of this approach is that it focuses attention on the production side of the economy, where interstate differences are likely to be more significant, rather than on the consumption side, where interstate differences are relatively small.

The report found that the CLEAR Act will lead to job creation in two ways:

- First, the shift of private expenditures from fossil fuels to greater spending on energy efficiency and renewable energy will create jobs, since the latter sectors are more labor-intensive.
- Second, public investments from the CERT Fund will create jobs, and the distribution of these jobs across the states can be influenced by Congressional decisions on the allocation of CERT expenditures.

The market price signals created by the cap on carbon emissions will lead to a reorientation of household and business expenditures away from fossil fuels, and will increase private spending on energy efficiency and renewable energy. There will be job losses in the fossil fuel sector, and job gains in other sectors such as construction, mass transportation, wind power, solar power, and alternative liquid fuels.

Spending on energy efficiency and renewables generates considerably more jobs per dollar than spending on fossil fuels (Table II-5), in part because EE&RE are more labor-intensive and in part because they have higher domestic content. The authors estimated that the net effect of this private expenditure shifting will be substantial job creation, and that job growth resulting from private expenditure shifting may surpass the jobs created by public investment from the CERT Fund. They focused

on public investments, since this is the main avenue by which Congress can shape the interstate distribution of job creation resulting from the CLEAR Act.

Table II-5
Employment Impacts Of Spending On Fossil Fuels, Energy Efficiency And Renewable Energy

Sector	Job creation (# of jobs per $ million)
Fossil fuels	
Oil and natural gas	3.7
Coal	4.9
Energy efficiency	
Building retrofits	11.9
Mass transit/freight rail	15.9
Smart grid	8.9
Renewables	
Wind	9.5
Solar	9.8
Biomass	12.4

Source: Political Economy Research Institute, 2010.

To estimate how many jobs CERT Fund investments would create in each state, under the investment allocation formula, the authors translated public expenditures into jobs using the methodology developed previously by PERI.[17] Their estimates included the jobs created in these industries and in other industries that supply intermediate goods (such as steel and building supplies) to them.[18]

[17]See Robert Pollin, James Heintz, and Heidi Garrett-Peltier, *The Economic Benefits of Investing in Clean Energy.,* Amherst, Massachusetts, Political Economy Research Institute and Washington, D.C., Center for American Progress, 2009. This study used input-output data at the state level from the U.S. Department of Commerce to estimate the number of jobs per dollar of spending on energy efficiency (building retrofits, smart grid, public transportation, and co-generation) and renewable energy (on-grid renewable electricity, off-grid renewables, and alternative motor fuels).

[18]They assumed that CERT Funds are allocated across different types of energy efficiency and renewable energy investments in the same proportions assumed in the earlier PERI study. They did not count induced employment effects from the consumption multiplier (that is, jobs created when workers in these industries spend their earnings to buy goods and services), because CERT Fund investments recycle carbon permit revenues rather than creating additional demand as in an economic stimulus program.

The results derived are summarized in Table II-6. The data refer to the year 2020, with a permit price of $25/ton CO_2. The report estimated that CERT Fund investments would create about 360,000 jobs nationwide, and the interstate differences in job creation that are shown in the table roughly mirror the interstate allocation of CERT dollars. A different allocation formula would yield a different interstate pattern of job creation. The CLEAR Act itself does not prejudge what is the "best" distribution across states or sectors, leaving allocation decisions up to the annual legislative process.

Table II-6
CERT Fund Investment And Job Creation By State
(2020, With Permit Price Of $25/Ton)

State	CERT investment ($ million)	Jobs created
Alabama	501	7,012
Alaska	57	667
Arizona	559	6,873
Arkansas	270	3,888
California	3,189	33,683
Colorado	454	5,705
Connecticut	280	3,160
Delaware	93	1,067
D.C	73	767
Florida	1,828	23,807
Georgia	967	13,080
Hawaii	108	1,377
Idaho	135	1,828
Illinois	1,193	14,182
Indiana	770	10,177
Iowa	312	4,178
Kansas	285	3,808
Kentucky	571	8,081
Louisiana	447	5,962
Maine	106	1,583
Maryland	508	6,012
Massachusetts	565	6,574
Michigan	1,029	13,012
Minnesota	504	6,462
Mississippi	284	4,143
Missouri	631	8,585

State	CERT investment ($ million)	Jobs created
Montana	91	1,294
Nebraska	168	2,246
Nevada	273	2,959
New Hampshire	99	1,312
New Jersey	736	8,354
New Mexico	187	2,647
New York	1,515	17,355
North Carolina	909	11,996
North Dakota	74	1,011
Ohio	1,244	16,715
Oklahoma	367	5,436
Oregon	312	4,151
Pennsylvania	1,120	14,435
Rhode Island	97	1,148
South Carolina	449	6,168
South Dakota	67	979
Tennessee	639	9,167
Texas	2,346	29,479
Utah	248	3,283
Vermont	42	619
Virginia	707	9,414
Washington	505	6,161
West Virginia	201	2,913
Wisconsin	560	7,319
Wyoming	81	1,057
US Average	**28,757**	**363,287**

Source: Political Economy Research Institute, 2010.

American Solar Energy Society, 2009

In January 2007, ASES published the report *Tackling Climate Change in the U.S.: Potential Carbon Emissions Reductions From Energy Efficiency and Renewable Energy by 2030* (TCC) which illustrated how energy efficiency (EE) and renewable energy technologies (RE) can provide the emissions reductions required to address global warming.[19] It analyzed energy efficiency in buildings, transportation, and industry, and assessed six RE technologies: Concentrating solar power, photovoltaics, wind power, biomass, biofuels, and geothermal power. The findings indicated that these technologies could displace approximately 1.2 billion tons of carbon emissions annually by 2030.[20] However, the report did not estimate the jobs impacts of the TCC initiatives, and ASES remedied this in a September 2009 report that estimated the jobs impacts through 2030 of the initiatives detailed in TCC.[21]

Addressing global warming and limiting temperature increases implies limiting carbon dioxide (CO_2) levels in the atmosphere to 450 to 500 parts per million, and estimates are that industrialized nations must reduce CO_2 emissions about 60 percent to 80 percent below current levels by mid-century. Figure II-10 shows the U.S. emissions reductions that would be required by 2030 to achieve this goal. Accounting for expected population and economic growth and associated increases in carbon emissions in a business-as-usual case indicates that in 2030 the U.S. needs to displace between 1,100 and 1,300 million metric tons of carbon per year.

TCC assessed EE&RE technologies to determine the potential carbon reduction for each, described the resource, discussed current and expected future costs, and developed supply and carbon-reduction curves for 2015 and 2030. ASES estimated the potential carbon reduction contributions from the various areas, and Figure III-11 shows the contributions through 2030. Approximately 57 percent of the total carbon reduction contribution is from EE and about 43 percent is from RE. Energy efficiency measures can allow U.S. carbon emissions to remain about level through 2030, whereas the renewable technologies can provide large reductions in carbon emissions below current levels.

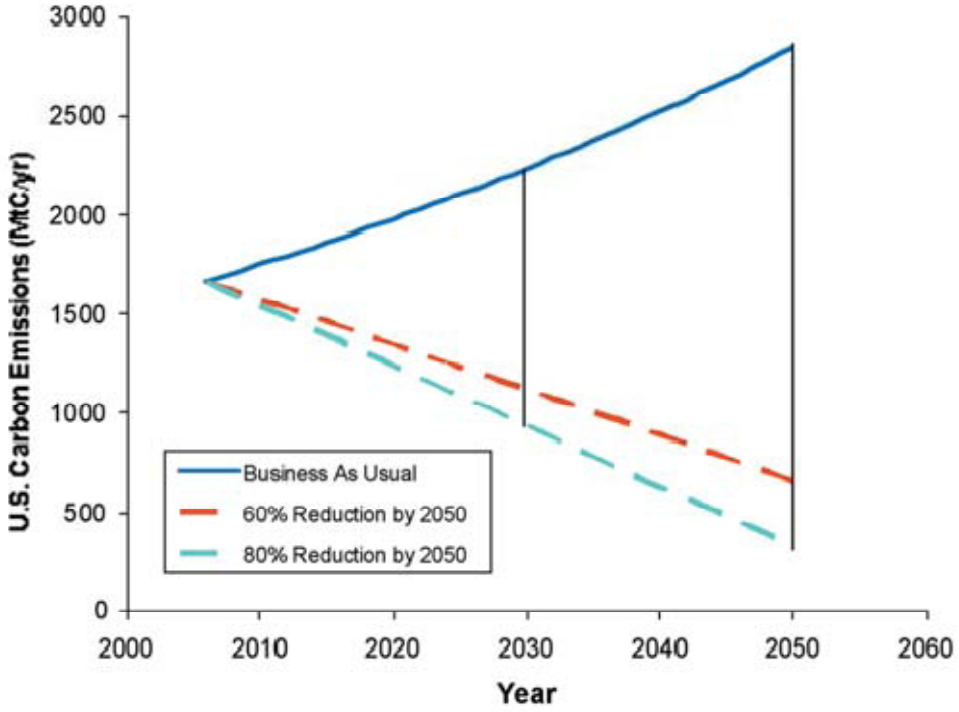
To address the potential costs of the TCC initiative, analysts examined the various technology costs in the TCC report. They then estimated how much each amount of deployment would cost in the year deployed.

[19]*Tackling Climate Change in the U.S.: Potential Carbon Emissions Reductions From Energy Efficiency and Renewable Energy by 2030,* Charles F. Kutscher, editor, American Solar Energy Society, January 2007.

[20]This is the magnitude of reduction that scientists believe is necessary to prevent the most dangerous consequences of climate change.

[21]Management Information Services, Inc., Estimating the Jobs Impacts of *Tackling Climate Change*, report prepared for the American Solar Energy Society, September 2009.

Figure II-10
U.S. Fossil Fuel Carbon Reductions Required by 2030



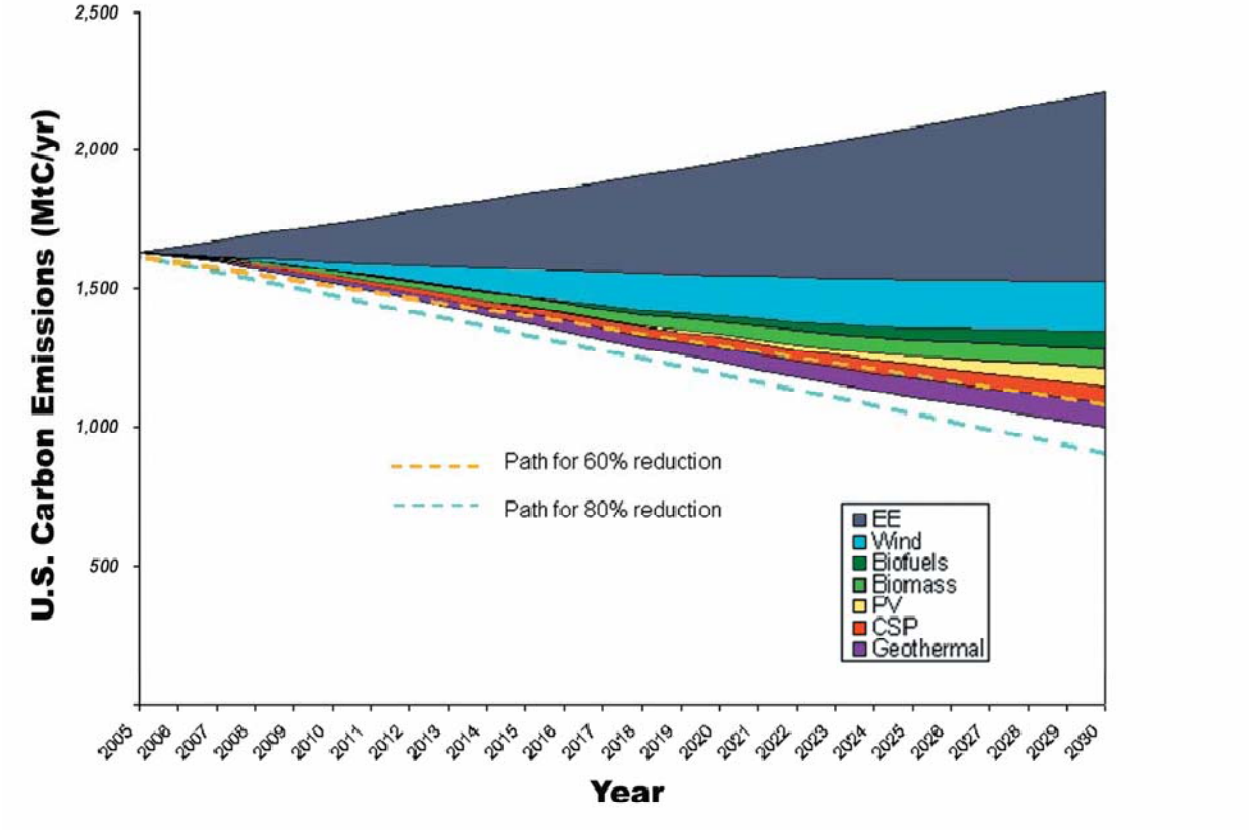
Source: American Solar Energy Society, 2007.

For each technology, they took into account supply curves and R&D and learning curves. Finally, current and projected costs of the conventional energy displaced were subtracted to derive the net cost. Figures II-12 and II-13 summarize the net jobs impact of the TCC initiative in 2020 and 2030.

Net job generation differs significantly among the RE components – by technology and time period:

- In 2020, the most jobs are generated by biofuels (261,000), followed by concentrating solar (156,000), wind (149,000), biomass (122,000), PV (105,000), and geothermal (93,000)
- In 2030, the most jobs are generated by PV (105,000), followed by biofuels (257,000), biomass (172,000), concentrating solar (147,000), geothermal (144,000), and wind (93,000)
- In 2030, more jobs are generated than in 2020 for biomass, PV, and geothermal
- In 2020, more jobs are generated than in 2030 for wind, biofuels, and concentrating solar

Figure II-11
Potential Carbon Reductions Required in 2030



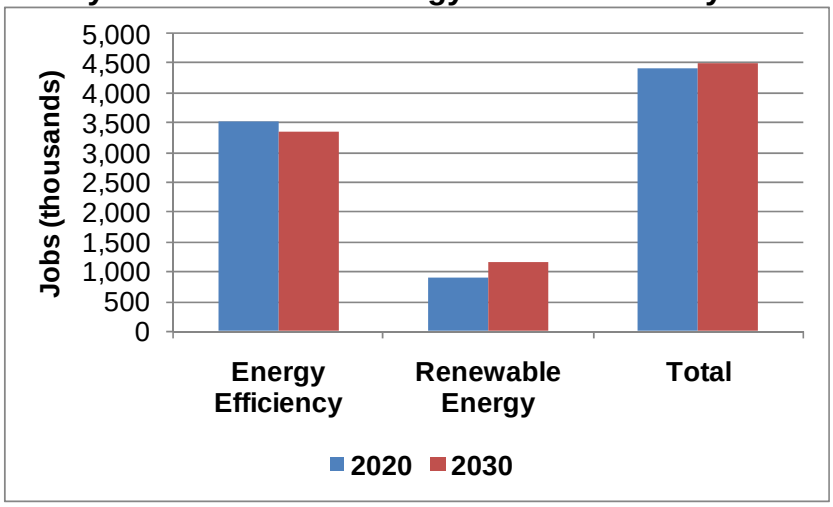
Source: American Solar Energy Society, 2007.

ASES thus estimated that the TCC Initiative, while requiring deployment costs in most years for most alternate energy technologies, would have an overwhelmingly positive impact on the U.S. economy.

The jobs impacts by industry of the TCC initiative are summarized in Figure II-14. Examining the net jobs generated by industry from TCC initiative indicates that the impacts are well distributed throughout the U.S. economy.

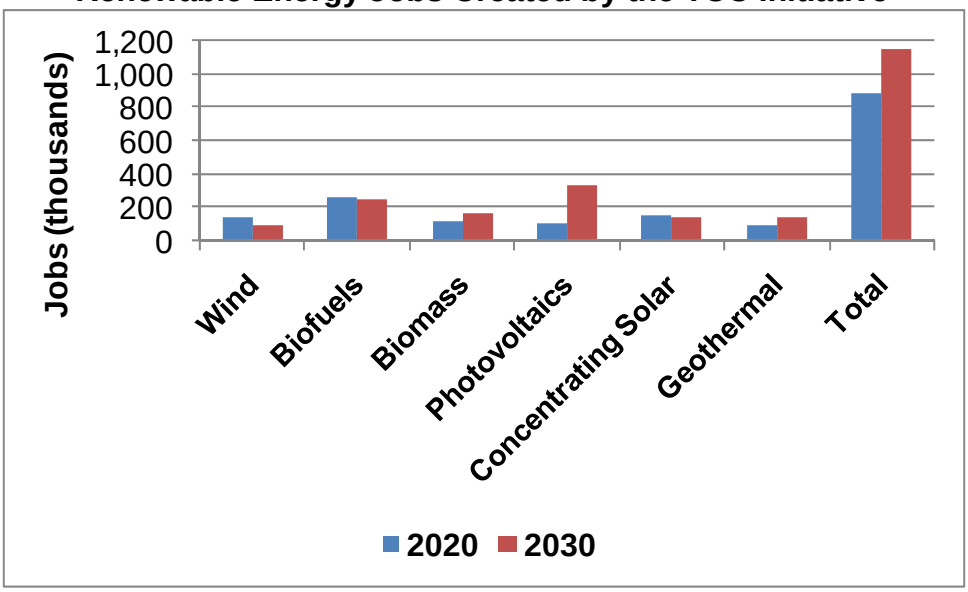
The vast majority of the jobs created by the TCC initiative are standard jobs for accountants, engineers, computer analysts, clerks, factory workers, truck drivers, mechanics, etc. This is illustrated in Figure II-15, which shows the jobs created by the TCC initiative in 2030 within selected occupations. Thus, occupational data demonstrate that the TCC initiative will create a variety of high-paying jobs, many of which take advantage of manufacturing skills currently going unused as manufacturing continues to undergo restructuring in the U.S.

Figure II-12
Energy Efficiency and Renewable Energy Jobs Created by the TCC Initiative



Source: American Solar Energy Society, 2009.

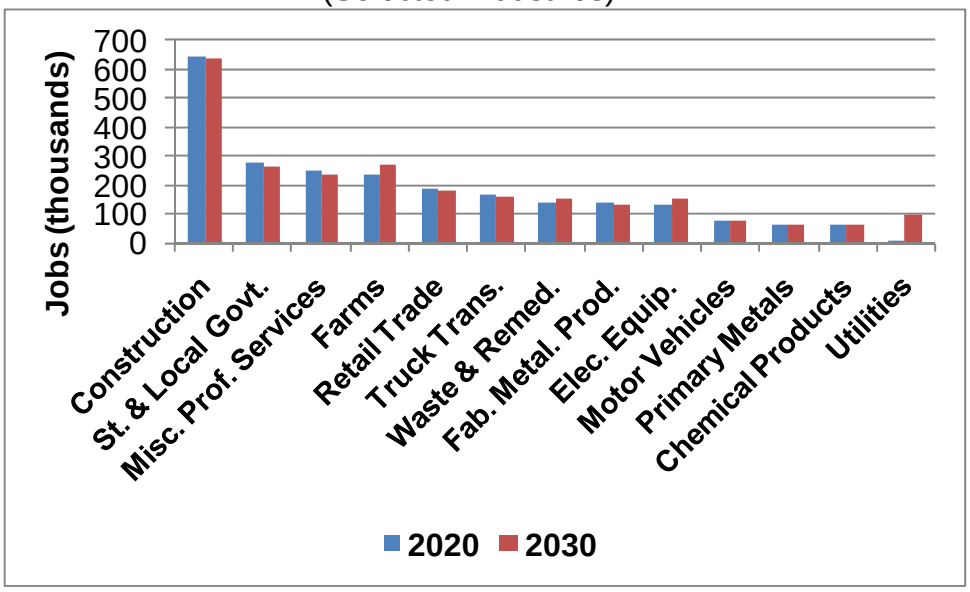
Figure II-13
Renewable Energy Jobs Created by the TCC Initiative



Source: American Solar Energy Society, 2009.

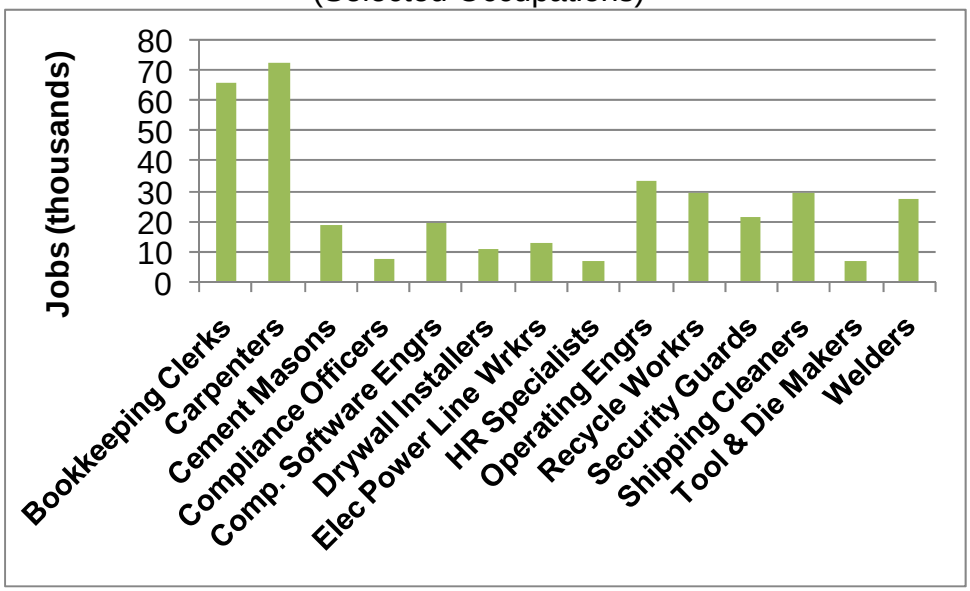
The jobs estimate is net jobs. Any ambitious climate change mitigation program will both create jobs and will cause job losses in different sectors, industries, and occupations. However, ASES estimated that, in total, more than 4.5 million more jobs will be created by the TCC initiative than will be lost. These jobs will be widely dispersed throughout the U.S. in virtually all industries and occupations. Thus, the major conclusion of this study is that the TCC initiative will be a major net job creator for the U.S. economy.

Figure II-14
Net Jobs by Industry Generated by the TCC Initiative in 2020 and 2030
(Selected Industries)



Source: American Solar Energy Society, 2009.

Figure II-15
Net Jobs by Occupation Generated by the TCC Initiative in 2030
(Selected Occupations)



Source: American Solar Energy Society, 2009.

United Nations Environment Program, Sustainable Energy Finance Alliance, 2009

In June 2009, the UNEP Sustainable Energy Finance Alliance (SEFI) published a report that highlighted the relationship between public clean energy spending and economic health.[22] SEFI compiled and assessed the latest and most comprehensive evidence linking government clean energy spending with key indicators of economic health, such as job creation and growth. It found that countercyclical investment in sustainable energy is a sound response to recession when economic factors are considered alone, independently from demands of the global ecosystem.

In a comparison of policy options on a strictly economic basis, the report found that green spending creates more jobs, per dollar, than most other types of stimulus spending; and three to four times as many jobs, per dollar, as tax cuts. The report also found that green investment is one of the most effective types of economic stimulus spending in terms of both job creation and economic growth, as well as providing various other economic and environmental benefits. Investments in clean energy and energy efficiency programs increase GDP, incomes, and jobs, reduce pollution and GHGs, save energy, reduce energy costs, and reduce energy price fluctuations.

SEFI noted that there is a large and growing interest in many nations in using "green" spending programs (renewable energy, energy efficiency, environmental initiatives, etc.) as economic stimulus and job creation programs, and the report addressed a number of issues, including:

- Do green programs facilitate economic growth and job creation, or do they retard these?
- Do green programs create more or fewer jobs than other types of programs, per dollar of spending?
- How do the stimulus effects of green spending programs compare to those of tax cuts?

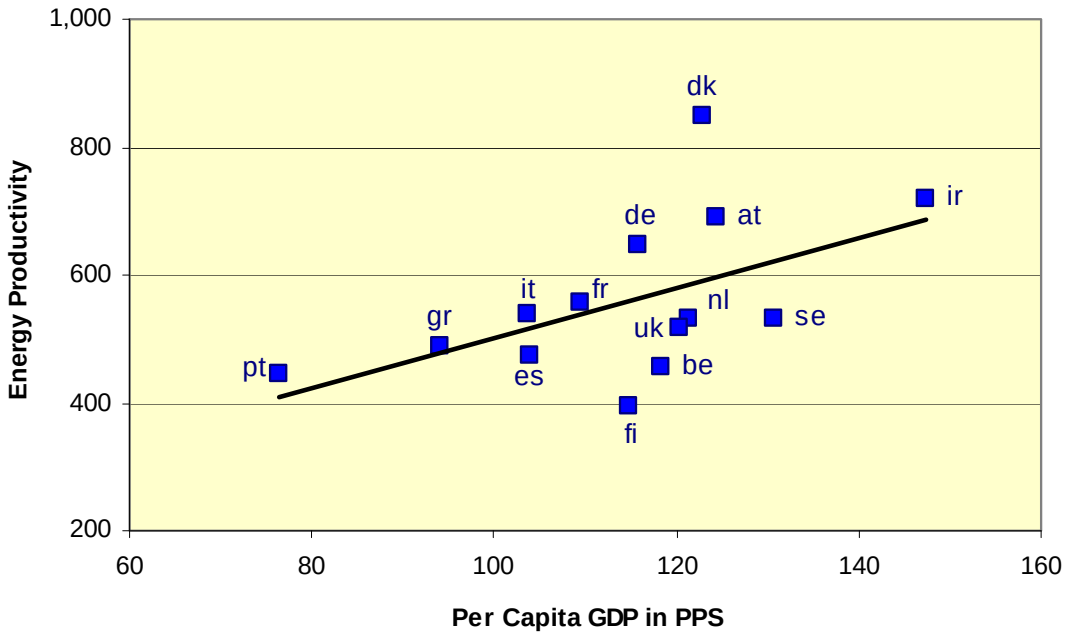
The report found that green programs facilitate economic growth and job creation: Government investments in these programs stimulate economic growth and job creation, as well as providing various other economic and environmental benefits. It concluded that there is a strong positive relationship between clean energy/energy efficiency/environmental investments and economic prosperity and job growth. For example:

- Figure II-16 shows that the relationship between economic efficiency and economic prosperity is positive: The more energy efficient the economy, the more prosperous it is.
- Figure II-17 shows the net job creation in California over the past three decades from investments in green energy programs – total

[22]United Nations Environmental Program, Sustainable Energy Finance Alliance, *Why Clean Energy Public Investment Makes Economic Sense – The Evidence Base*, June 2009.

job gains in excess of the jobs lost in the fossil fuel industries and the carbon fuel supply chain. By 2007, annual net job creation totaled nearly 450,000 in the state.

Figure II-16
Energy Efficiency and Economic Prosperity - 2006



Source: Eurostat and UNEP/SEFI, 2009.

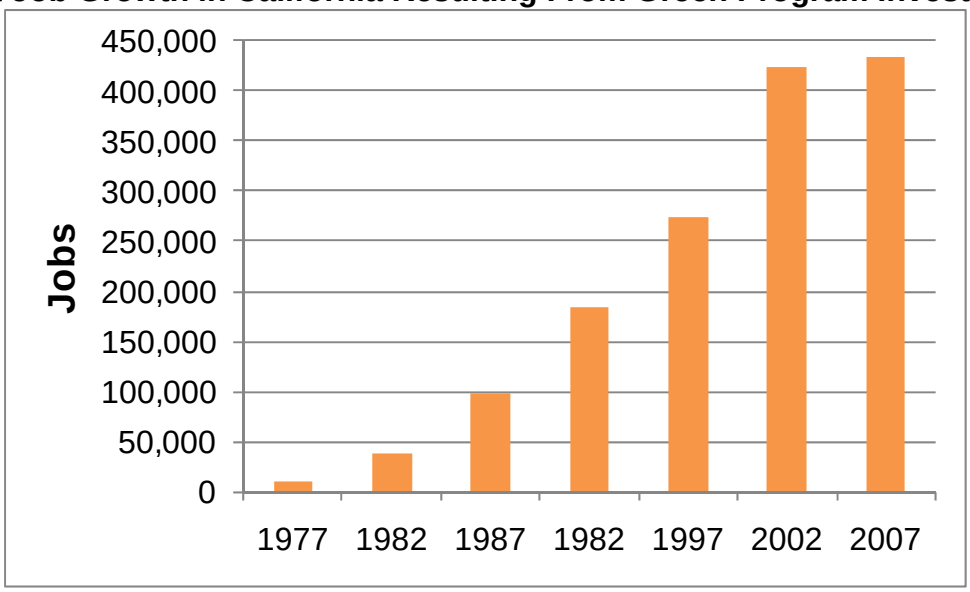
Thus, investments in clean energy and energy efficiency programs increase GDP, incomes, and jobs, reduce pollution and GHGs, save energy, reduce energy costs, and reduce energy price fluctuations. Further, the relationship between i) clean energy, energy efficiency, and environmental programs and ii) economic growth and job creation is positive, not negative.

UNEP/SEFI also found that government spending on green stimulus programs is, dollar for dollar, more effective in creating jobs as is equivalent spending on more traditional alternatives, such as road construction or fossil fuel energy programs. These findings are summarized in Figure II-18, which illustrates the relative job creation of different types of government spending programs. For example, it shows that, per dollar of spending:

- Photovoltaics creates more than 50 percent more jobs than highway construction.
- Biomass creates nearly twice as many jobs as does health care
- Insulation programs create nearly three times as many jobs as municipal infrastructure.

- Mass transit creates more than four times as many jobs as utility programs.

Figure II-17
Net Job Growth in California Resulting From Green Program Investments



Source: University Of California and UNEP/SEFI, 2009.

More generally, this figure shows that:

- Investments in green stimulus and infrastructure programs, usually generate, per dollar expenditure, more jobs than most alternatives.
- Investments in energy efficiency programs are especially beneficial and cost effective, and often have negative net economic costs.
- Clean energy programs are powerful job creators, but the job creation effects depend importantly on the specific clean energy program and technology.

The report thus concluded that the green stimulus programs being implemented in many nations will likely act as expeditious and effective job creation mechanisms.

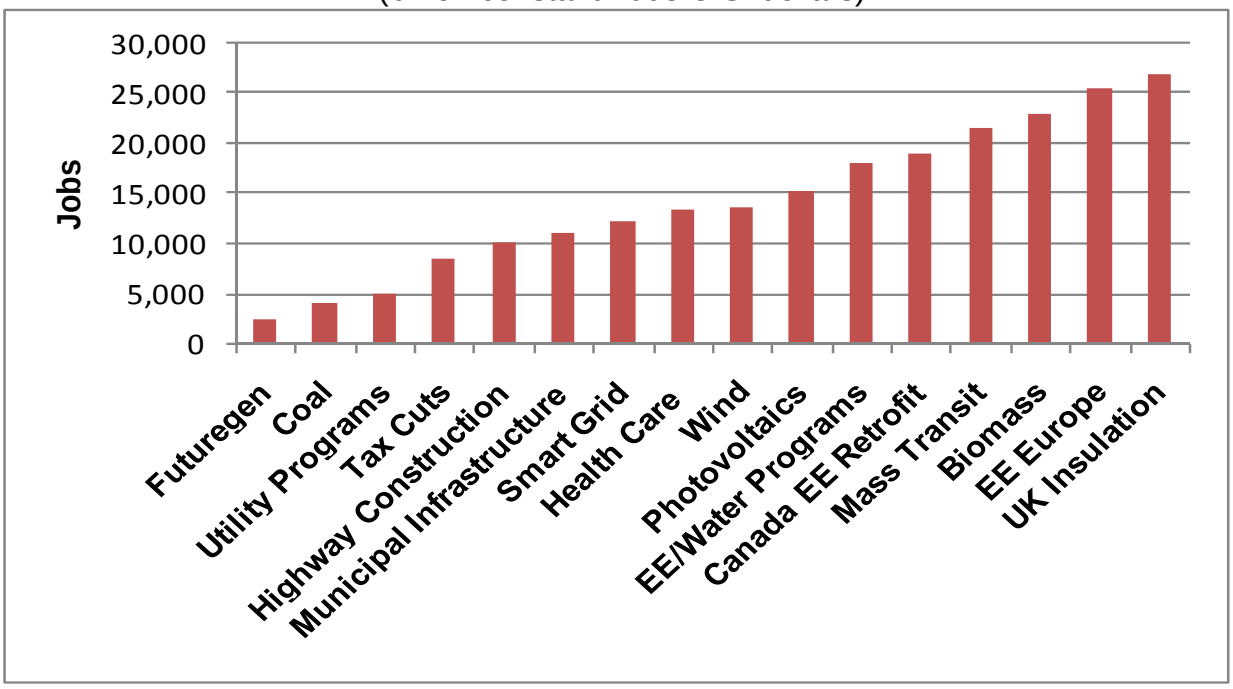
Finally, the report determined that green stimulus programs generate about three or four times as many jobs, per dollar, as do tax cuts. This is emphasized in Figure II-19, which shows that, per billion dollars:

- Smart grid investments create 50 percent more jobs than tax cuts.
- Wind programs create 60 percent more jobs than tax cuts.
- Photovoltaics creates nearly twice as many jobs as tax cuts.

- Water conservation programs create more than twice as many jobs as tax cuts.
- Mass transit creates nearly three times as many jobs as tax cuts.
- Biomass creates nearly three times as many jobs as tax cuts.
- Insulation programs create more than three times as many jobs as tax cuts.

The report's findings thus reinforce UNEP's recommendation for a global green new deal in response to the financial and economic crisis and indicated that clean energy can be a key driver in the transition toward a green economy.

Figure II-18
Jobs Generated Per Billion Dollars of Expenditure on Selected Programs
(billion constant 2008 U.S. dollars)



Source: UNEP/SEFI, 2009.

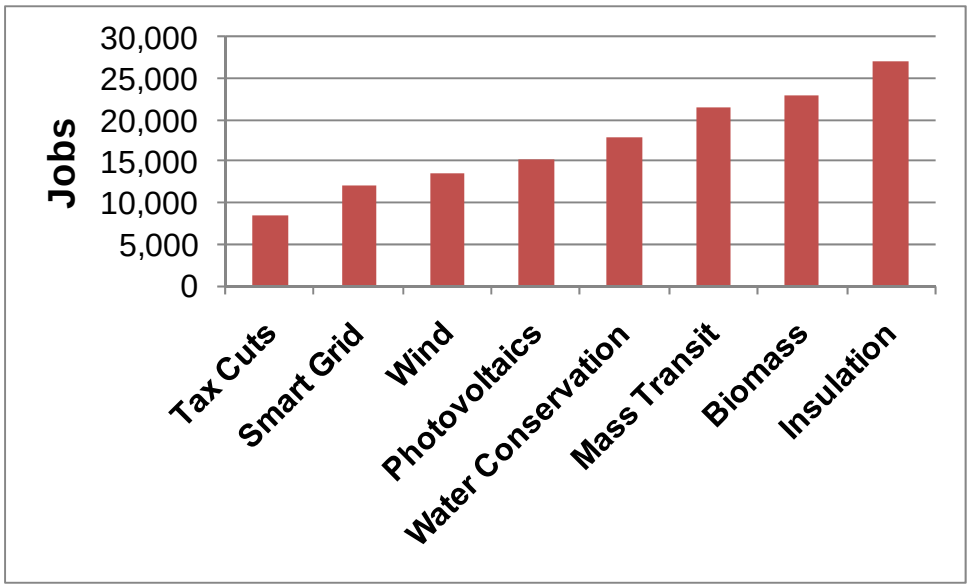
Coalition for Affordable American Energy, 2009

This CAAE report analyzed the potential economic impacts of the climate provisions contained in the Obama Administration's FY 2010 Budget Proposal.[23] The study examined the cap and trade policy described in the Administration's FY 2010 Budget Proposal, including the stated caps on U.S. GHG emissions and proposals for

[23]Coalition for Affordable American Energy, *Impact on the Economy of the Climate Provision in the Obama Administration's FY 2010 Budget*, report prepared by CRA International, April 2009.

use of the revenues to fund renewable energy programs, the “Making Work Pay” tax credits, and other transfer payments.

Figure II-19
Jobs Generated Per Billion Dollars of Expenditure on Tax Cuts and Selected Green Programs
(billion constant 2008 U.S. dollars)



Source: UNEP/SEFI, 2009.

The report found that these climate provisions would have significant economic and energy market impacts and that market shares would shift within the energy sector. Natural gas is projected to expand its market share, particularly for power generation. Increased imports of natural gas are estimated to supply most of the increased domestic demand for natural gas, whereas domestic natural gas production is projected to increase slightly. Both oil and coal are estimated to decline in market share. These measures would tend to lower rates of return on investments in the production of domestic oil and petroleum products. With lower rates of return, domestic investment levels would fall. Domestic crude oil and refined products production are projected to decline, while the share of renewable energy is estimated to rise.

The results also indicated that business users and consumers would face higher energy costs and the resulting higher energy production and transportation costs would lead to increased costs of goods and services throughout the economy. As these latter costs rise, household disposable income and household consumption would fall. The cap and trade policy would cause more investment in costly forms of renewable energy, thereby directing funding away from investments with greater potential to enhance productivity, and the economy would grow more slowly and job growth would decline. Overall, the economy would be expected to grow more slowly, leading to substantial

differences in disposable income and personal consumption -- Table II-7. Specific economic impacts, beginning in the 2012, include the following:

- CO_2 emissions would be reduced through decreased use of conventional energy. As the cap progressively tightens, the cost of reducing emissions becomes more expensive and the cost of a carbon allowance increases. In 2015, the cost of a carbon allowance is estimated to be \$29/mtCO_2. By 2020, the allowance cost increases to \$66/mtCO_2 and by 2030 the allowance cost could reach \$116/mtCO_2.
- The cost of energy is projected to increase relative to the baseline as a result of the substitution away from less costly conventional fuels. Natural gas demand, primarily for electricity generation, is projected to increase as coal-generated electricity is backed out due to tightening GHG emission caps and motor fuel costs are projected to increase. After a 39 percent increase (\$4.70 per MMBtu) in natural gas costs by 2020, natural gas costs increase by 56 percent (\$7.20 per MMBtu) by 2025. After an estimated 48 ¢/gal increase in 2020, motor fuel costs increase 19 percent (74 ¢/gal). Electricity costs increase 27 percent (3.6 ¢/ kWh) in 2020, rising by 44 percent (5.8 ¢/kWh) in 2025.
- After an initial net job loss of 800,000 in 2015, net job losses are projected to more than double by 2020 to 1.9 million and continue to increase to 3.2 million jobs by 2025. This estimated employment impact is inclusive of jobs that would be created by the budget proposal. While all regions of the country would be adversely impacted, the Southeast, Oklahoma, Texas, and California would be disproportionately affected.
- Projected impacts on household purchasing power would be severe: Per household purchasing power is estimated to decline by \$1,020 in 2015, by \$1,381 in 2020, and \$2,127 by 2030.
- Aggregate U.S. investment is projected to drop by 1.3 percent below the baseline level in 2015, but then is projected to increase over the 2020 – 2030 timeframe as required investments in lower emitting GHG technologies and energy efficiency improvements are put in place to comply with ever more stringent carbon caps. By 2030, investment is 5.6 percent above the baseline level. The increasingly stringent carbon caps redirect capital from higher to lower productive uses, and this shift would have a large adverse impact on productivity growth.
- By 2025, GDP is estimated to be 0.7 percent (\$150 billon) below the baseline level, driven principally through declining consumption. Commercial transportation services, electric generation, and agriculture would be among the most affected sectors. In 2030, GDP is 0.2 percent (\$39 billon) below the baseline level.

Table II-7
Summary of Projected Economic Impacts
(Change from Projected Baseline)

	2015	2020	2025	2030
U.S. Job Losses (Millions)	0.8	1.9	3..2	3.2
Change in U.S. Household Purchasing Power (S2008 per Household)	-$1020	-$1,381	-$1,823	-$2127
Percent Change in U.S. GDP	-0.3%	-0.4%	-0.7%	-0.2%
Percent Change in U.S. Investment	-1.3%	+0.6%	+0.3%	+5.6%
Percent Change in Natural Gas Cost	16% ($1.90 /MMBtu)	39% ($4.70 /MMBtu)	56% ($7.2 0/MMBtu)	53% ($7.70 /MMBtu)
Percent Change in Motor Fuel Cost	6% (21 Cents/Gallon)	13% (48 Cents/Gallon)	19% (74 Cents/Gallon)	20% (78 Cents/Gallon)
Percent Change in Electricity Cost	15% (2 Cents/ kWh)	27% (3.6 Cents/ kWh)	44% (5.8 Cents/ kWh)	51% (6.6 Cents/ kWh)

Source: Coalition for Affordable American Energy, 2009.

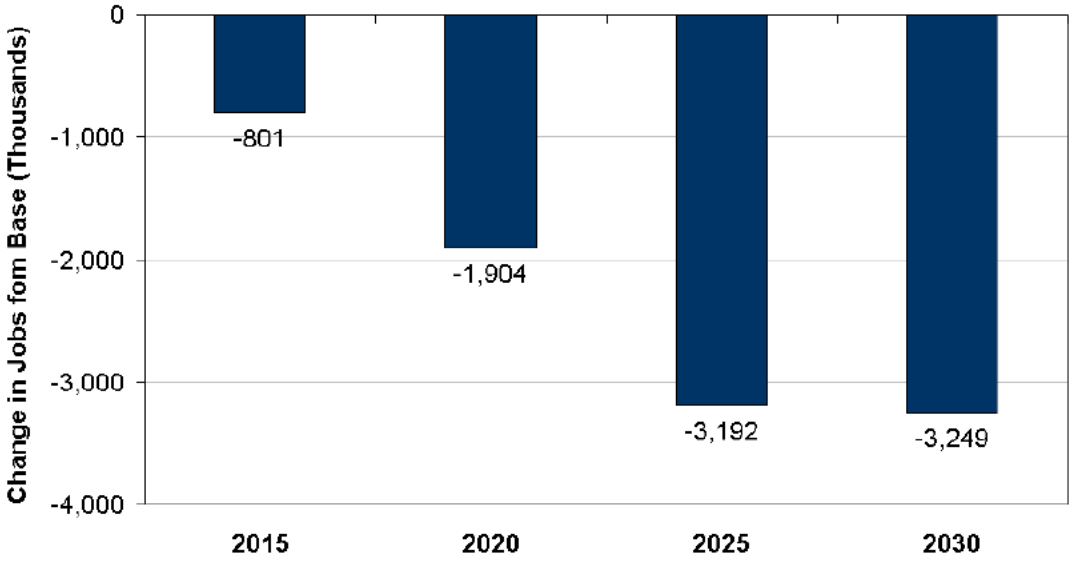
There would be significant changes to energy supply and consumption:

- There would be a shift towards the use of natural gas in the next decade in large measure because of increased use of natural gas for electricity generation. By 2025, U.S. demand for natural gas is estimated to increase by 3.0 Tcf relative to the baseline level. This demand increase would result in an estimated cost increase of natural gas to consumers of 56 percent ($7.20 per MMBtu) by 2025. By 2030, the impact on demand lessens to 1.5 Tcf.
- Most of the estimated natural gas demand growth would be met by imports. Increased costs for domestic oil and natural gas producers retard development of domestic natural gas resources. By 2025, natural gas imports rise by 160 percent (2.0 Tcf) above the baseline level, whereas domestic natural gas production increases by only 5 percent (0.7 Tcf).
- The increased costs imposed on U.S.-located refineries to cover facility GHG emissions would not be faced by refineries located outside the U.S., which would put U.S. refineries at a competitive disadvantage.
- Demand for refined products would be reduced, and this decline would fall disproportionately on U.S. producers. U.S. production of refined products is projected to decline relative to baseline levels by 604 - 2,151 MBOE/day (3.9 to 13.6 percent annually), 2020-2030.

Higher energy costs would cause decreases in demand for goods and services and, in addition, as the expected costs of energy services climb, the productivity of capital and labor tend to fall. Business activity is likely to contract, the demand for labor

would tend to weaken, and employment is projected to decline relative to the baseline. Figure II-20 illustrates that 2015 job losses are estimated to be 0.8 million, they more than double by 2020 to 1.9 million job losses, and by 2025 - 2030, job losses increase to 3.2 million. These employment impacts are inclusive of jobs that would be created. Figure II-21 indicates that while job losses would be distributed throughout the country, the southeast, California, Oklahoma, and Texas would be disproportionately affected.

Figure II-20
Projected Changes to Non-Farm Employment



Source: CRA Model Results, 2009

Center for American Progress, 2008

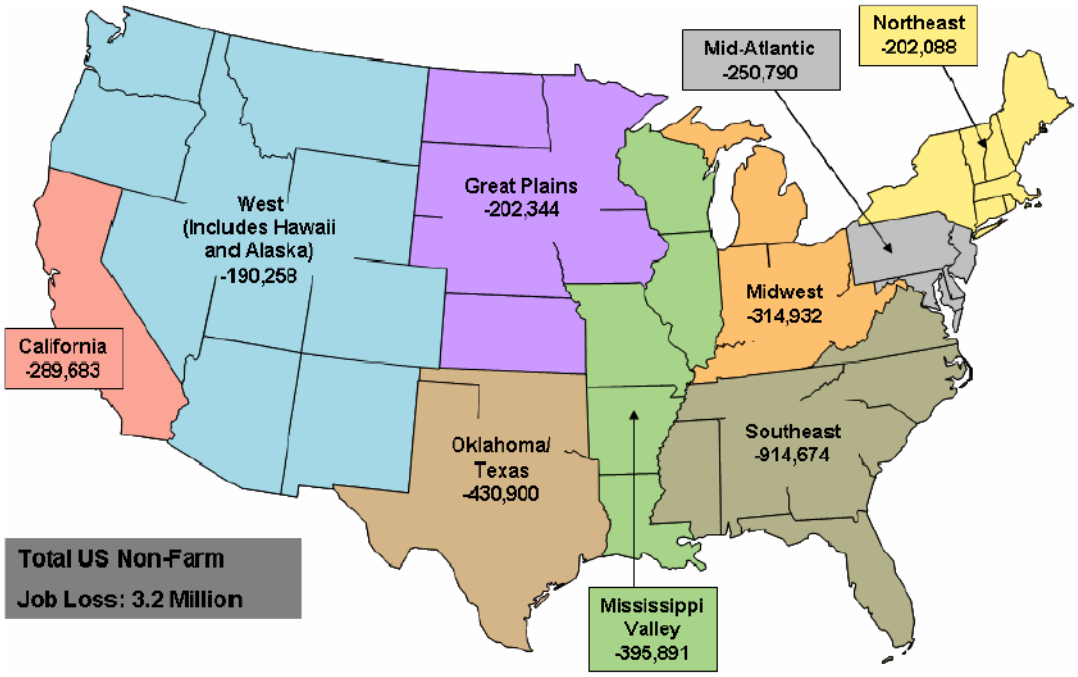
This 2008 CAP report advocated a "green economic recovery program to strengthen the U.S. economy over the next two years and leave it in a better position for sustainable prosperity."[24] This initiative was designed to expand job opportunities, stimulate economic growth, stabilize the price of oil, fight global warming, and build a green, low-carbon economy. The green economic recovery program would be a down payment on a 10-year policy program recommended by CAP in its 2007 "Progressive Growth" series, which recommended an economic strategy for the next administration.

The report's recommended green economic recovery program would spend $100 billion dollars over two years in six green infrastructure investment areas, and would be paid for with proceeds from auctions of carbon permits under a GHG cap-and-trade program. The authors estimated that the program would create 2 million jobs by investing in six energy efficiency and renewable energy strategies:

[24]Center for American Progress, *Green Recovery: A Program to Create Good Jobs and Start Building a Low-Carbon Economy*, report prepared by the Department of Economics and the Political Economy Research Institute (PERI) at the University of Massachusetts-Amherst, September 2008.

- Retrofitting buildings to improve energy efficiency
- Expanding mass transit and freight rail
- Constructing “smart” electrical grid transmission systems
- Wind power
- Solar power
- Next-generation biofuels

Figure II-21
Projected Regional Distribution of Changes to Non-Farm Employment in 2025



Source: Coalition for Affordable American Energy, 2009.

Most of the federal spending would be in public building retrofits, public transportation, and building smart grid systems and through the federal government to state and local governments. Investments in renewable energy and energy efficiency are also central to this proposal, and would be funded through a combination of public funds, tax credits, and loan guarantees to encourage private sector investment. CAP recommended that this $100 billion green energy stimulus package should be spent in the six technology areas listed above. The program would allocate the funding through tax credits ($50 billion), direct government spending ($46 billion), and Federal loan guarantees ($4 billion). CAP estimated that this would result in widespread employment gains, lower unemployment, renewed construction and manufacturing work, more stable oil prices, and self-financing energy efficiency. CAP also recommended establishment of numerous new government entities, including:

- A White House National Energy Council
- An Energy Innovation Council

- An Energy Technology Corporation
- A Clean Energy Investment Administration
- A Clean Energy Jobs Corps

The report found that:

- "Green energy" investments generate both more jobs than equivalent investments in other energy technologies and that these jobs also pay higher than average wages.
- The recommended investments in energy efficiency and renewable energy sources would stabilize demand for oil and slow the long-term rise in oil prices.
- The program would reduce U.S. oil demand by one percent and would reduce world oil prices by eight percent.
- The program would create 2 million new jobs and reduce the U.S. unemployment rate by nearly 25 percent.
- The investments in energy efficiency would be self financing.
- Renewable energy does not receive enough federal subsidies compared to fossil fuels.

II.C. U.S. Energy Information Administration Reports

EIA has conducted numerous studies of the impact of climate change legislation. Several of the more notable of these are summarized below.

EIA, August 2009

This report examined the energy-related provisions in ACESA that can be analyzed using EIA's National Energy Modeling System (NEMS).[25] The Reference Case used as the starting point for the analysis was an updated version of the *Annual Energy Outlook 2009* (*AEO2009*) Reference Case issued in April 2009. Key provisions of ACESA analyzed include:[26]

- The GHG cap-and-trade program for gases other than HFCs,
- The combined efficiency and renewable electricity standard
- The CCS demonstration and early deployment program
- Federal building code updates
- Federal efficiency standards for lighting and other appliances
- Technology improvements
- The smart grid peak savings program

[25]U.S. Energy Information Administration, *Energy Market and Economic Impacts of H.R. 2454, the American Clean Energy and Security Act of 2009*, SR/OIAF/2009-05 August 2009.
[26]EIA did not address all the provisions of ACESA, and its analysis did not account for any possible health or environmental benefits that might be associated with curtailing GHG emissions.

While the emissions caps decline through 2050, the modeling horizon in this report runs only through 2030, the projection limit of NEMS.[27] EIA prepared a range of analysis cases, and the six main analysis cases focused on two key areas of uncertainty that impact the analysis results. First, the role of offsets is a large area of uncertainty in any analysis of ACESA. The 2-BMT annual limit on total offsets in ACESA is equivalent to 1/3 of total energy-related 2008 GHG emissions and represents nearly six times the projected growth in energy-related emissions through 2030.

The other major area of uncertainty involves the timing, cost, and public acceptance of low- and no-carbon technologies. For the period prior to 2030, the availability and cost of low- and no-carbon baseload electricity technologies, such as nuclear power and fossil with CCS, which can potentially displace a large amount of conventional coal-fired generation, is a key issue. However, technology availability over an extended horizon is a two-sided issue. R&D breakthroughs over the next two decades could expand the set of reasonably priced and scalable low- and no-carbon energy technologies, with opportunities for widespread deployment beyond 2030. The achievement of significant near-term progress towards such an outcome, however, could significantly reduce the size of the bank of allowances that covered entities and other market participants would want to carry forward to meet compliance requirements beyond 2030.

The main analysis cases discussed in this report are as follows:[28]

- The ACESA Basic Case assumed that key low-emissions technologies, including nuclear, fossil with CCS, and renewables, are deployed in a timeframe consistent with the emissions reduction requirements and that use of offsets is not constrained.
- The ACESA Zero Bank Case is similar to the Basic Case except that no banked allowances are held in 2030.
- The ACESA High Offsets Case is similar to the Basic Case except that it assumed the near immediate use of international offsets.
- The ACESA High Cost Case is similar to the Basic Case except that the costs of nuclear, coal with CCS, and biomass are assumed to be 50 percent higher.
- The ACESA No International Case is similar to the Basic Case, but assumed that the use of international offsets is severely limited.
- The ACESA No International/Limited Case combined the treatment of offsets in the ACESA No International Case with an assumption that deployment of key technologies cannot expand beyond their Reference Case levels through 2030.

[27] As in EIA analyses of earlier cap-and-trade proposals, the need to pursue higher-cost emissions reductions beyond 2030, driven by tighter caps and continued economic and population growth, can be analyzed by assuming that a positive bank of allowances is held at the end of 2030 in all but one case.

[28] EIA also discussed a number of additional analysis cases, including an enhanced CAFE standards case, a 5-percent discount case, a case with limitations to the penetration of nuclear, CCS, and biomass gasification, an accelerated energy technology case, and a higher level of allowance banking case.

EIA found that the reduction in covered emissions is exceeded by the amount of compliance generated through offsets in most of the main analysis cases. Cumulative compliance between 2012 and 2030 ranges from 24.4 BMT to 37.6 BMT CO_2-equivalent emissions in the main analysis cases, representing a 21 - 33 percent reduction from the cumulative covered emissions projected in the Reference Case.

Most reductions in energy-related emissions are expected to occur in the electric power sector. Across the ACESA main cases, the electricity sector accounts for between 80 and 88 percent of the total reduction in energy-related CO_2 emissions in 2030. Reductions in electricity-sector emissions are primarily achieved by reducing conventional coal-fired generation and increasing the use of no- or low-carbon generation technologies. In addition, a portion of the electricity-related CO_2 emissions reductions results from reduced electricity demand. If new nuclear, renewable, and fossil plants with CCS are not deployed in a timeframe consistent with emissions reduction requirements under ACESA, covered entities respond by increasing their use of offsets and by increasing natural gas use to offset reductions in coal generation.

Emissions reductions from changes in fossil fuel use in the residential, commercial, industrial, and transportation sectors are small relative to those in the electric power sector. Taken together, changes in fossil fuel use in these sectors account for between 12 percent and 20 percent of the total reduction in energy-related CO_2 emissions relative to the Reference Case in 2030.

GHG allowance prices are sensitive to the cost and availability of emissions offsets and low-and no-carbon generating technologies. Allowance prices in the ACESA Basic Case are projected at $32/mt in 2020 and $65/mt in 2030. Across all main analysis cases, allowance prices range from $20/mt to $93/mt in 2020 and from $41/mt to $191/mt (2007 dollars) in 2030.

ACESA increases energy prices, but effects on electricity and natural gas bills are mitigated through 2025 by the allocation of free allowances to utilities. Electricity prices in five of the six main ACESA cases range from 9.5¢/kWh to 9.6¢/kWh in 2020, only 3 to 4 percent above the Reference Case level. Average impacts on electricity prices in 2030 are projected to be substantially greater and in 2030 range from 10.7¢/kWh to 17.8 ¢/kWh. ACESA thus increases the cost of using energy, which reduces real economic output and purchasing power, and lowers aggregate demand. The result is that projected real GDP generally falls relative to the Reference Case. Total discounted GDP losses over the 2012 to 2030 time period are $566 billion (-0.3 percent) in the ACESA Basic Case, with a range from $432 billion (-0.2 percent) to $1,897 billion (-0.9 percent) across the main ACESA cases (Table II-8).

Consumption and energy bill impacts can also be expressed on a per household basis. In 2020, the reduction in household consumption is $134 (2007 dollars) in the ACESA Basic Case, with a range of $30 to $362 across all main ACESA cases. In 2030, household consumption is reduced by $339 in the ACESA Basic Case, with a range of $157 to $850 across all main ACESA cases.

Table II-8
Macroeconomic Impacts of ACESA Cases Relative to the Reference Case
(billion 2000 dollars, except where noted)

	Basic	Zero Bank	High Offsets	High Cost	No International	No Int / Limited
Cumulative Real Impacts 2012-2030 (present value using 4-percent discount rate)						
GDP						
Change	-566	-432	-523	-781	-717	-1897
Percent Change	-0.3%	-0.2%	-0.2%	-0.4%	-0.3%	-0.9%
Consumption						
Change	-273	-196	-252	-384	-323	-988
Percent Change	-0.2%	-0.1%	-0.2%	-0.3%	-0.2%	-0.7%
Industrial Shipments (excludes services)						
Change	-910	-753	-480	-958	-1720	-2877
Percent Change	-1.0%	-0.8%	-0.5%	-1.1%	-1.9%	-3.2%
Nominal Revenue Collected 2012-2030[a]	2971	1292	1332	2299	3462	6350
2020 Impacts (not discounted)						
GDP						
Change	-50	-19	-26	-70	-34	-112
Percent Change	-0.3%	-0.1%	-0.2%	-0.5%	-0.2%	-0.7%
Consumption						
Change	-21	-7	-11	-30	-15	-64
Percent Change	-0.2%	-0.1%	-0.1%	-0.3%	-0.1%	-0.6%
Industrial Shipments (excludes services)						
Change	-68	-54	-32	-69	-108	-186
Percent Change	-1.0%	-0.8%	-0.5%	-1.0%	-1.6%	-2.8%
Nominal Revenue Collected[a]	71	44	46	79	118	215
2030 Impacts (not discounted)						
GDP						
Change	-161	-104	-120	-214	-226	-453
Percent Change	-0.8%	-0.5%	-0.6%	-1.1%	-1.1%	-2.3%
Consumption						
Change	-63	-36	-50	-97	-69	-180
Percent Change	-0.4%	-0.3%	-0.4%	-0.7%	-0.5%	-1.3%
Industrial Shipments (excludes services)						
Change	-183	-125	-87	-198	-338	-506
Percent Change	-2.5%	-1.7%	-1.2%	-2.7%	-4.6%	-6.8%
Nominal Revenue Collected[a]	330	205	211	367	556	1030

Source: U.S. Energy Information Administration, 2009.

EIA, April 2008

This report was a response to a request from Senators Lieberman and Warner for an analysis of S. 2191, the Lieberman-Warner Climate Security Act of 2007, a complex bill regulating emissions GHGs through market-based mechanisms, energy

efficiency programs, and economic incentives.[29] To analyze the provisions of S. 2191, several alternative cases were prepared:

- The S. 2191 Core Case assumed that key low-emissions technologies, including nuclear, fossil with CCS, and various renewables, are deployed in a timeframe consistent with the emissions reduction requirements.
- The S. 2191 No International Offsets Case, is similar to the S. 2191 Core Case, but assumed that use of international offsets is limited.
- The S. 2191 High Cost Case is similar to the S.2191 Core Case except that the costs of nuclear, coal with CCS, and biomass are assumed to be 50 percent higher than in the Core Case.
- The S. 2191 Limited Alternatives Case assumes the deployment of key technologies, including nuclear, fossil with CCS, and various renewables, is held to their Reference Case level through 2030, as are imports of LNG.

EIA's key findings included the following:

- S. 2191 significantly reduces projected GHG emissions compared to the Reference Case. Projected covered emissions in the S. 2191 cases, net of offsets, are 27 percent to 36 percent lower in 2020 and 45 percent to 56 percent lower in 2030.
- The electric power sector accounts for most of the emissions reductions, with new nuclear, renewable, and fossil plants with CCS serving as the key compliance technologies. Electric power accounts for 82 - 87 percent of energy-related CO_2 emissions reductions in 2020 and 82 - 92 percent of such reductions in 2030.
- If new nuclear, renewable, and fossil plants with CCS are not deployed rapidly enough, covered entities are projected to turn to increased natural gas use to offset reductions in coal generation, resulting in markedly higher delivered prices of natural gas.
- Emissions reductions in the residential, commercial, industrial, and transportation sectors are small relative to those in the electric power sector, and energy price increases are not large enough to induce consumers to make large changes in their energy use.
- Coal consumption is significantly reduced, and total coal consumption in 2030 ranges between 62 and 89 percent below the Reference Case level.
- GHG allowance prices are sensitive to the cost and availability of low-carbon generating technologies and emissions offsets. Estimated allowance prices range from \$30 to \$76/mtCO_2e in 2020 and from \$61 to \$156/mtCO_2e in 2030.

[29]U.S. Energy Information Administration, *Energy Market and Economic Impacts of S. 2191, the Lieberman-Warner Climate Security Act of 2007*, SR/OIAF/2008-01, April 2008.

- S. 2191 increases energy prices and energy bills for consumers. Relative to the Reference Case, the price of using coal for power generation is 161 - 413 percent higher in 2020 and 305 - 804 percent higher in 2030. The price of electricity is 5 - 27 percent higher in 2020 and 11 - 64 percent higher in 2030. Under S. 2191, average annual household energy bills, excluding transportation costs, are $30 - $325 higher in 2020 and $76 - $723 higher in 2030.
- S. 2191 increases the cost of using energy, which reduces real economic output, reduces purchasing power, and lowers aggregate demand, and GDP falls relative to the Reference Case. Adverse economic impacts increase over time, and discounted GDP losses, 2009 – 2030, range from $444 billion (-0.2 percent) to $1,308 billion (-0.6 percent) -- Table II-9.
- S. 2191 impacts industrial activity, including manufacturing, to a greater extent than the overall economy. Industrial shipments in 2030 are reduced by $233 - $589 billion (-2.9 to -7.4 percent).

Table II-9
Macroeconomic Impacts of S. 2191 Cases and S. 1766 Update Cases
(billion 2000 dollars, except where noted)

	S. 2191 Cases					S1766 Update
	Core	High Cost	Limited Alternatives	No International Offsets	Limited Alternatives No International	
Cumulative Real Impacts 2009-2030 (Present Value using 4% Discount Rate)						
GDP						
Change	(444)	(729)	(912)	(546)	(1,306)	(66)
Percent Change	-0.2%	-0.3%	-0.4%	-0.2%	-0.6%	-0.03%
Consumption						
Change	(558)	(785)	(946)	(780)	(1,422)	(145)
Percent Change	-0.3%	-0.5%	-0.6%	-0.5%	-0.9%	-0.1%
Industrial Shipments (excludes services)						
Change	(1,340)	(1,723)	(2,031)	(2,430)	(3,684)	(722)
Percent Change	-1.3%	-1.7%	-2.0%	-2.4%	-3.6%	-0.7%
Nominal Revenue collected 2012-2030[a]	2,851	3,650	4,282	4,416	7,659	987

Source: U.S. Energy Information Administration, 2008.

EIA, January 2007

This EIA report responded to a request from Senators Bingaman, Landrieu, Murkowski, Specter, Salazar, and Lugar for an analysis of a proposal that would regulate GHG emissions through a cap-and-trade system. The proposal was modeled using NEMS and compared to the reference case projections from the *Annual Energy Outlook 2006* (AEO 2006).[30] The major findings included:

[30]U.S. Energy Information Administration, *Energy Market and Economic Impacts of a Proposal to Reduce Greenhouse Gas Intensity With a Cap and Trade System*, SR/OIAF/2007-01, January 2007.

- The proposal leads to lower GHG emissions, but the intensity reduction targets are not fully achieved after 2025.
- Relative to the reference case, covered GHG emissions less offsets are 562 $MMTCO_2e$ (7.4 percent) lower in 2020 and 1,259 $MMTCO_2e$ (14.4 percent) lower in 2030 in the Phased Auction case. Covered GHG emissions grow by 24 percent between 2004 and 2030, about half the increase in the reference case.
- Initially, when allowance prices are relatively low, reductions in GHG emissions outside the energy sector are the predominant source of emissions reductions. By 2030, the reduction in energy related CO_2 emissions account for most emissions reductions.
- In 2004 dollars, the allowance prices rise from \$3.70/$mtCO_2$ in 2012 to the safety valve price of \$14.18/$mtCO_2$ in 2030.
- The cost of GHG allowances is passed through to consumers, raising the price of fossil fuels charged and providing an incentive to lower energy use and shift away from fossil fuels.
- The average delivered price of coal to power plants in 2020 increases from \$1.39/MMBTU in the reference case to \$2.06, an increase of 48 percent. By 2030 the change grows from \$1.51/ MMBTU to \$2.73/ MMBTU, an increase of 81 percent.
- Electricity prices are lower in the Phased Auction case than in the Full Auction case because the Phased Auction provides a portion of the allowances to the electric power sector for free.
- Relative to the reference case, annual per household energy expenditures in 2020 are 2.6 percent (\$41) higher in the Phased Auction case and 3.6 percent (\$58) higher in the Full Auction case. By 2030, projected annual household energy expenditures range from 7.0 percent to 8.1 percent (\$118 to \$136) higher.
- Coal use is projected to continue to grow, but at a much slower rate than in the reference case. Total energy from coal increases by 23 percent between 2004 and 2030, less than half the 53 percent increase projected in the reference case.
- The proposal significantly increases nuclear capacity additions and generation. The projected 47 GW increase in nuclear capacity between 2004 and 2030 allows nuclear to continue to provide about 20 percent of U.S. electricity in 2030.
- The proposal adds significantly to renewable generation. In the reference case, renewable generation is projected to increase from 358 BkWh in 2004 to 559 BkWh in 2030.
- Retail gasoline prices in 2030 are 11 ¢/gal higher in 2030, leading to modest changes in vehicle purchase and travel decisions.
- The Phased Auction and Full Auction cases have similar energy market impacts, but the macroeconomic impacts differ – Table II-10.

- In the Phased Auction case, wholesale energy prices rise steadily and, by 2030, are 12 percent above the reference case levels. This represents 8 percent higher energy prices at the consumer level by 2030 and a 1 percent increase in the CPI.
- In the Phased Auction case, discounted total GDP (2000 dollars) over the 2009-2030 time period is $232 billion (0.10 percent) lower than in the reference case, while discounted real consumer spending is $236 billion (0.14 percent) lower. In 2030, in the Phased Auction case, real GDP is $59 billion (0.26 percent) lower and consumption expenditures are $55 billion (0.36 percent) lower.

Table II-10
Economic Impacts of Phased and Full Auction Cases

Projection	2004	2020			2030		
		AEO2006 Reference	Phased Auction	Full Auction	AEO2006 Reference	Phased Auction	Full Auction
Allocation of Allowance Revenue (billion nominal dollars)							
Private Spending	-	-	39.0	0.0	-	58.6	0.0
States	-	-	21.4	0.0	-	54.9	0.0
Government Spending	-	-	0.0	0.0	-	0.0	0.0
Debt Reduction	-	-	13.3	73.7	-	86.4	199.9
Total Revenue	-	-	73.7	73.7	-	199.9	199.9
Aggregate Prices in the Economy							
WPI – Fuel & Power (1982 =1.0)	1.27	1.77	1.88	1.88	2.49	2.79	2.79
CPI – Energy (1982/84 = 1.0)	1.51	2.19	2.27	2.28	2.96	3.20	3.20
CPI – All Urban (1982/84 = 1.0)	1.89	2.86	2.88	2.87	3.78	3.82	3.80
Inflation Rate, Unemployment Rate and the Federal Funds Rate (percent)							
Inflation	2.68	3.06	3.13	3.10	2.67	2.68	2.68
Unemployment Rate	5.53	4.37	4.44	4.46	4.90	5.01	5.02
Federal Funds Rate	1.35	5.24	5.24	5.16	5.04	4.96	4.86
Components of GDP (billion 2000 dollars)							
GDP	10,756	17,541	17,520	17,503	23,112	23,053	23,018
Disposable Income	8,004	13,057	13,037	12,991	17,562	17,468	17,367
Consumption	7,589	11,916	11,898	11,880	15,352	15,298	15,247
Investment	1,810	3,293	3,291	3,288	4,985	4,990	4,973
Government	1,952	2,464	2,474	2,464	2,838	2,861	2,839
Exports	1,118	3,776	3,759	3,765	6,833	6,785	6,813
Imports	1,719	3,659	3,660	3,647	6,156	6,165	6,121

Source: U.S. Energy Information Administration, 2008.

III. JOB IMPACTS OF RENEWABLE ENERGY AND ENERGY EFFICIENCY PROGRAMS REQUIRED TO ADDRESS CLIMATE CHANGE

III.A. The American Clean Energy and Security Act

The American Clean Energy and Security Act of 2009, (ACESA or Waxman-Markey), would establish a cap-and-trade (C&T) system for greenhouse gases (GHG) to address climate change. The government sets a limit on the total amount of GHGs that can be emitted, and the cap is reduced over time to reduce total carbon emissions. The bill was approved by the House of Representatives on June 26, 2009 and represents the first time either house of Congress has approved a bill designed to reduce GHG emissions.

Other key provisions of the Bill include:

- A requirement for electric utilities to meet 20 percent of their electricity demand through renewable energy and energy efficiency by 2020[31]
- Investments in new clean energy technologies and energy efficiency, including renewable energy ($90 billion in new investments by 2025), carbon capture and sequestration ($60 billion), electric and other advanced technology vehicles ($20 billion), and basic scientific research and development ($20 billion)
- Provisions for modernization of the electrical grid
- Provisions for expanded production of electric vehicles
- Mandates for significant increases in energy efficiency in buildings, home appliances, and electricity generation

The Bill contains five major titles:

- I. Clean energy
- II. Energy Efficiency
- III. Reducing global warming pollution
- IV. Transitioning to a clean energy economy
- V. Agriculture and forestry related offsets

These are summarized below.

[31]ACES includes a renewable electricity standard (which is almost identical to a renewable portfolio standard, but narrowly tailored to electrical energy) requiring each electricity provider who supplies over 4 million MWh to produce 20 percent of its electricity from renewable sources (such as wind, solar, and geothermal) by 2020. There is a provision whereby five percent of this standard can be met through energy efficiency savings, as well as an additional three percent with certification of the Governor of the state in which the provider operates. Alternative compliance payments are $25/mWh in violation of the standard, adjusted for inflation beginning in 2010.

III.A.1. Title I: Clean Energy

The major components of Title I include the following:

- Renewable Energy. The Bill promotes renewable energy by requiring retail electricity suppliers to meet 20 percent of their load by 2020 with electricity generated from renewable resources, including wind, biomass, solar, and geothermal. The governor of any state may choose to meet one fifth of this requirement with energy efficiency measures.
- Carbon Capture and Sequestration (CCS). The Bill promotes development of CCS technologies to ensure a continuing place for coal in the U.S. energy future. The legislation includes a CCS early demonstration program, incentives for the wide-scale commercial deployment of CCS, and performance standards for new coal-fired power plants.
- Clean Fuels and Vehicles. The legislation establishes a new low-carbon transportation fuel standard to promote advanced biofuels and other clean transportation fuels and authorizes financial support in the form of grants or loan guarantees to cities, states, or private companies for large-scale demonstrations of electric vehicles.
- Smart Grid and Electricity Transmission. ACESA contains provisions to facilitate deployment of a smart grid, including measures to reduce utility peak loads through smart grid and demand response applications and to help promote smart grid capabilities in new home appliances. It also directs FERC to reform the regional planning process to modernize the electric grid and provide for new transmission lines to carry electricity generated from renewable sources.
- Partnering with the States. The Bill creates a program to allow each state energy office to establish a State Energy and Environment Development (SEED) Fund, which will serve as a common repository for federal financial assistance for clean energy and energy efficiency projects.
- Federal Purchases of Renewable Electricity. Federal agencies are authorized to enter into long-term contracts to purchase renewable electricity.

III.A.2. Title II: Energy Efficiency

The major components of Title II include the following:

- Building Energy Efficiency. ACESA promotes energy efficiency in new buildings by providing federal training and funding assistance to states that adopt advanced building efficiency codes. It

authorizes funding for retrofitting existing commercial and residential buildings to improve their energy efficiency and it directs EPA to develop procedures for rating building energy efficiency.

- Manufactured Homes. The Bill provides rebates to low-income families residing in pre-1976 manufactured homes that can be applied toward purchases of new Energy Star-rated manufactured homes.
- Appliance Energy Efficiency. The Bill codifies four negotiated agreements on efficiency standards for lighting and four additional agreements for other appliances.
- Transportation Efficiency. ACESA directs the President to work with the relevant agencies and California to harmonize the federal fuel economy standards, any emission standards promulgated by EPA, and the California standards for light-duty vehicles. It also directs EPA to set emissions standards for other mobile sources of pollution, requires states to establish goals for reducing global warming pollution from the transportation sector, and requires large metropolitan planning organizations to submit transportation plans to meet those goals.
- Utilities Energy Efficiency. The Bill establishes a new energy efficiency resource standard to enlist electricity and natural gas distribution companies in the effort to make the nation more energy efficient.
- Industrial Energy Efficiency. The Bill requires the Secretary of Energy to establish standards for industrial energy efficiency and to seek recognition of the result by ANSI. It also creates an award program for innovation in increasing efficiency of thermal electric generation process.
- Public and Federal Energy Efficiency. The legislation amends the Energy Independence and Security Act of 2007 to include nonprofit hospitals and public health facilities among public institutions eligible for grants and loans for energy efficiency.

III.A.3. Title III: Reducing Global Warming Pollution

- Global Warming Pollution Reduction Program. The Bill establishes a market-based program for reducing global warming pollution from electric utilities, oil companies, large industrial sources, and other covered entities that collectively are responsible for 85 percent of U.S. global warming emissions. Covered entities must have tradable federal permits, “allowances,” for each ton of pollution emitted, but entities that emit less than 25,000 tons/yr. of CO_2 equivalent are not covered.
- Supplemental Pollution Reductions. EPA is directed to achieve additional reductions in global warming pollution by entering into agreements to prevent international deforestation.

- Offsets. The Bill allows covered entities to increase their emissions above their allowances if they can obtain "offsetting" reductions at lower cost from other sources. The total quantity of offsets allowed in any year cannot exceed 2 billion tons, split evenly between domestic and international offsets.
- Banking and Borrowing. The Bill permits unlimited banking of allowances for use during future compliance years and establishes a rolling two-year compliance period, effectively allowing covered entities to borrow from one year ahead without penalty.
- Strategic Reserve. EPA is directed to create a "strategic reserve" of about 2.5 billion allowances by setting aside a small number of allowances authorized to be issued each year thereby creating a cushion in case prices rise faster than expected.
- Carbon Market Assurance and Oversight. The Bill provides for oversight and regulation of the new markets for carbon allowances and offsets, ensures market transparency and liquidity, and establishes penalties for fraud and manipulation.
- Additional GHG Standards. EPA is directed to set emission standards on sources that are not covered by the allowance system. The Bill also creates special programs to reduce emissions of two pollutants that contribute to global warming: Hydrofluorocarbons (HFCs) and black carbon.

III.A.4. Title IV – Transitioning To A Clean Energy Economy

- Ensuring Domestic Competitiveness. To ensure that U.S. manufacturers are not put at a disadvantage relative to overseas competitors, the Bill authorizes companies in certain industrial sectors to receive "rebates" to compensate for additional costs incurred under the program. Sectors that use large amounts of energy, and produce commodities that are traded globally, would be eligible for the rebates.
- Green Jobs and Worker Transition. ACESA includes several provisions to promote green jobs.
- Exporting Clean Technology. The Bill includes provisions to provide U.S. assistance to encourage widespread deployment of clean technologies to developing countries.
- Adapting to Global Warming. The Bill establishes an interagency council to ensure an integrated federal response to the effects of global warming.
- The Bill creates an International Climate Change Adaptation Program within USAID to provide U.S. assistance to the most vulnerable developing countries for adaptation to climate change.

III.A.5. Title V -- Agriculture And Forestry Related Offsets

Title V of the bill establishes an offset program specific to domestic agriculture and forestry sources. This program would be administered by the Secretary of Agriculture.

III.B. ACESA Cap and Trade Program

ACESA covers seven GHGs: Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3). Entities covered by the proposal include large stationary sources emitting more than 25,000 tons/yr. of GHGs, producers and importers of all petroleum fuels, distributors of natural gas to residential, commercial and small industrial users, producers of "F-gases," and other specified sources. The proposal also calls for regulations to limit black carbon emissions in the U.S.

The Bill establishes emission caps that would reduce aggregate GHG emissions for all covered entities to three percent below their 2005 levels in 2012, 17 percent below 2005 levels in 2020, 42 percent below 2005 levels in 2030, and 83 percent below 2005 levels in 2050. Commercial production and imports of HFCs would be addressed under Title VI of the existing Clean Air Act and are covered under a separate cap. The bill also establishes economy-wide goals for all sources, including but not limited to those covered by the C&T program. These goals are the same percentage reduction and timetables as the cap-and-trade program, except that the 2020 target is 20 percent rather than 17 percent below 2005 levels.

The Bill utilizes the value of emission allowances to offset the cost impacts on consumers and workers, to aid businesses in transitioning to clean energy technologies, to support technology development and deployment, and to support activities aimed at building communities that are more resilient to climate change. Consumers are protected from higher energy prices by providing allowances to electricity and natural gas local distribution companies with a mandate that the value of such allowances be used for the benefit of consumers. Low and moderate income households will also receive a refundable tax credit or rebate.

In the initial years of the C&T program, approximately 20 percent of allowances are auctioned, but this percentage increases over time to about 70 percent by 2030 and beyond. Emission allowances are also provided to energy intensive, trade- exposed businesses, merchant coal generators, and oil refineries to aid in their transition away from carbon-based fuels. To support investment in clean technologies, allowance value is used to support advanced vehicle technology and is allocated to states to establish State Energy and Environmental Development (SEED) Accounts to encourage RE&EE programs. Allowances are also provided to support programs aimed at cutting emissions by reducing deforestation in developing countries and for emission reductions from agriculture and forestry sources in the U.S. Overall, the vast majority of value

created through emission allowances will be used to protect consumers and to support technological advances.

III.C. The Job Impacts of ACESA

MISI analyzed three scenarios to estimate the industry employment impacts in 2020 and 2030 of RE&EE initiatives and related programs designed to address climate change:

- The first scenario was a reference case or "business as usual" scenario that assumed that neither the ACESA initiatives nor any other ambitious climate change mitigation programs will be implemented over the next two decades. This scenario was based on the EIA reference case forecast.
- The second scenario, the Basic Case, was based primarily on the RE&EE and related provisions contained in ACESA, as described above.
- The third scenario, the High Technology (HT) Case was more ambitious than the second scenario and assumed that RE&EE programs are implemented that will enable the U.S. to achieve a 25 percent RPS.

For all three scenarios, industry employment impacts at the 70-order North America Industrial Classification System (NAICS) were estimated.

The three scenarios were used for comparative purposes. The ACESA Reference Case used, as a starting point for this analysis, the updated version of EIA's *Annual Energy Outlook 2009* published in April 2009.[32] It also incorporated the projected impacts of the:

- American Recovery and Reinvestment Act,
- Energy Improvement and Extension Act of 2008
- Energy Independence and Security Act of 2007
- Energy Policy Act of 2005.

Provisions of ACESA that are included in the two alternate cases developed here include:

- The GHG cap-and-trade program for gases other than HFC's, including provisions for the allocation of allowances to electricity and natural gas distribution utilities, low-income consumers, state efficiency programs, rebate programs, and energy-intensive industries

[32]U.S. Energy Information Administration, *Annual Energy Outlook 2009*, April 2009.

- The combined efficiency and renewable electricity standards for electricity sellers
- The carbon capture and storage demonstration and early deployment program
- Federal building code updates for residential and commercial buildings
- Federal efficiency standards for lighting and other appliances
- Technology improvements resulting from the Centers for Energy and Environmental knowledge and outreach
- The smart grid peak savings program

III.C.1. Scenario 1: Reference Case

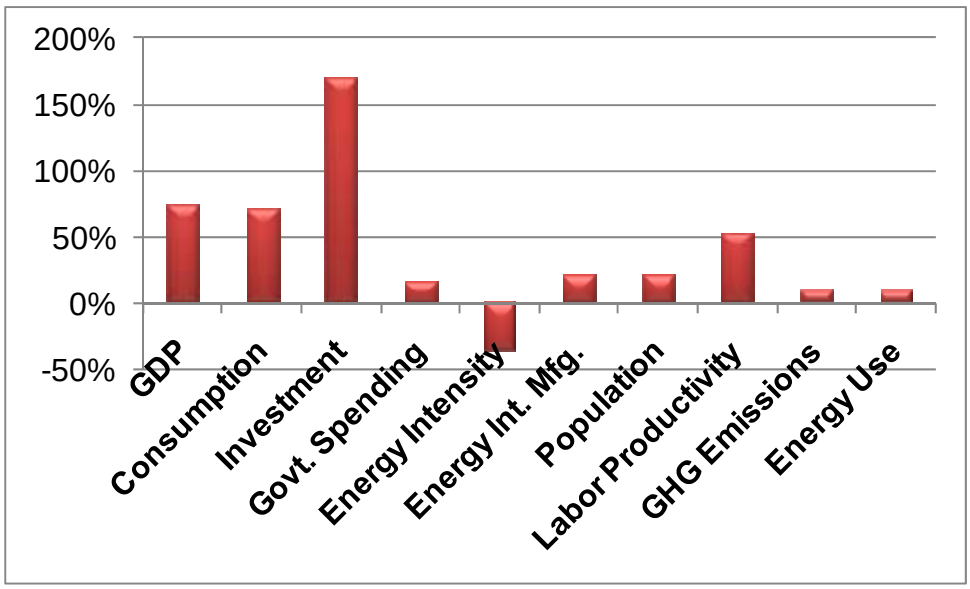
As noted, scenario 1 was a reference case or "business as usual" scenario that assumed that neither the ACESA initiatives nor any other ambitious climate change mitigation programs will be implemented over the next two decades. This scenario was based on the EIA reference case forecast, and the major forecast parameters for this reference case scenario are summarized in Table III-1 and Figure III-1.

Table III-1
EIA Economic Variables for Reference and Basic Cases

	Reference Case		
	2009	**2020**	**2030**
Real GDP (billion20'00 dollars)	11,333	15,398	19,875
Real Consumption	8,163	10,817	14,069
Real Investment	1,331	2,591	3,590
Real Government Spending	2,100	2,229	2,473
Real Exports	1,378	2,862	4,865
Real Imports	1,678	2,942	4,719
Energy Intensity (thous. Btu per '00$ GDP)			
Delivered Energy	6.26	4.83	3.97
Total Energy	8.65	6.80	5.58
Population (millions)	308.4	342.6	374.7
Key Labor Indicators			
Labor Force (millions)	153.5	166.4	175.6
Nonfarm Labor Productivity (1992=1.00)	1.42	1.75	2.17

Source: Management Information Services, Inc., 2010.

Figure III-1
Reference Case Forecasts
(Percent change, through 2030)



Source: Management Information Services, Inc., 2010.

This table and figure illustrate some salient U.S. economic, energy, and environmental trends for the next two decades:

- U.S. GDP increases 75 percent, while population increases 22 percent – indicating a significant rise in per capita GDP
- Most significant, investment spending increases 170 percent
- The energy intensity of the economy decreases 35 percent, indicating that the economy will become increasingly energy efficient
- Labor productivity increases by more than 50 percent
- Both energy consumption and GHG emissions increase nine percent

III.C.2. Scenario 2: The ACESA Basic Case

Scenario 2, the ACESA Basic Case, represents an environment where key low-emissions technologies, including nuclear, fossil with CCS, and various renewables, are developed and deployed on a large scale in a timeframe consistent with the emissions reduction requirements of ACESA without encountering any major obstacles. It also assumes that the use of offsets, both domestic and international, is not severely constrained by cost, regulation, or the pace of negotiations with key countries covering key sectors. In anticipation of increasingly stringent caps and rising allowance prices after 2030, covered entities and investors are assumed to amass an aggregate allowance bank of approximately 13 BMT by 2030 through a combination of offset usage and emission reductions that exceed the level required under the emission caps.

In addition to the energy and environmental indicators, the Reference Case and the Basic Case also included economic variable outputs from the National Energy Modeling System (NEMS). Those for 2009, 2020 and 2030 are included in Tables III-2 and III-3. Differences in the two cases are small:

- Real GDP is projected to increase an average of 2.7 percent per year over the 21 year period under both the Reference and the Basic cases, but GDP in the Basic Case will be $50 billion lower in 2030 (’00 constant dollars)
- Energy intensity is projected to decrease 2.3 percent per year under the Basic case, slightly faster than the 2.1 percent decrease in the Reference case
- Energy prices to consumers are projected to increase substantially more under the Basic case, reaching levels six percent higher in 2020 and 15 percent higher in 2030

Table III-2
EIA Economic Variables for Reference and Basic Cases

	Reference Case			Basic Case		
	2009	2020	2030	2009	2020	2030
Real Gross Domestic Product						
(billion '00 dollars, chain-weighted)	11,333	15,398	19,875	11,333	15,348	19,714
Components of Real GDP						
Real Consumption	8,163	10,817	14,069	8,163	10,796	14,006
Real Investment	1,331	2,591	3,590	1,331	2,585	3,557
Real Government Spending	2,100	2,229	2,473	2,100	2,239	2,460
Real Exports	1,378	2,862	4,865	1,378	2,840	4,795
Real Imports	1,678	2,942	4,719	1,678	2,965	4,744
Energy Intensity (thous. Btu per '00$ GDP)						
Delivered Energy	6.26	4.83	3.97	6.26	4.71	3.83
Total Energy	8.65	6.80	5.58	8.65	6.62	5.30
Price Indices						
GDP Chain-type Price Index (2000=1.000)	1.237	1.521	1.896	1.236	1.540	1.940
Consumer Price Index (1982-84=1.00)						
All-urban	2.12	2.79	3.58	2.12	2.82	3.68
Energy Commodities and Services	1.73	3.10	4.11	1.73	3.29	4.73
Wholesale Price Index (1982=1.00)						
All Commodities	1.65	2.12	2.47	1.65	2.20	2.68
Fuel and Power	1.43	2.66	3.62	1.43	2.92	4.40
Metals and Metal Products	1.68	2.10	2.18	1.68	2.13	2.24
Interest Rates (percent, nominal)						
Federal Funds Rate	0.15	5.40	5.00	0.15	5.44	5.08
10-Year Treasury Note	2.70	6.03	5.76	2.70	6.09	5.91
AA Utility Bond Rate	6.12	7.95	8.04	6.12	7.97	8.06
Population (millions)						
Population, with Armed Forces Overseas	308.4	342.6	374.7	308.4	342.6	374.7
Population, aged 16 and over	242.6	270.3	297.2	242.6	270.3	297.2
Population, over age 65	39.6	55.0	72.3	39.6	55.0	72.3
Key Labor Indicators						
Labor Force (millions)	153.5	166.4	175.6	153.5	166.3	175.3
Nonfarm Labor Productivity (1992=1.00)	1.42	1.75	2.17	1.42	1.74	2.16
Key Indicators for Energy Demand						
Housing Starts (millions)	0.60	1.99	1.77	0.60	1.99	1.73
Commercial Floorspace (billion square feet)	80.1	91.5	103.9	80.1	91.4	103.8
Unit Sales of Light-Duty Vehicles (millions)	10.26	18.09	19.69	10.27	17.93	19.21

Source: DOE/EIA, *Energy Market and Economic Impacts of H.R. 2454, the American Clean Energy and Security Act of 2009*, and MISI, 2010.

Table III-3
Summary Results of ACESA Reference and Basic Cases

2007	2020	2030

		Reference	Basic	Reference	Basic
Greenhouse gas emissions (mmt)					
Covered emissions					
Energy-related carbon dioxide	4,948	5,910	5,355	6,212	4,408
Other covered emissions	167	171	150	177	152
Total covered emissions	5,114	6,081	5,505	6,389	4,560
Noncovered emissions	2,242	1,411	1,388	1,665	1,624
Total greenhouse gas emissions	7,357	7,492	6,893	8,054	6,184
Offset credits (mmt)					
Noncovered gases	0	0	35	0	53
Biogenic sequestration	0	0	251	0	448
Total domestic offset credits	0	0	286	0	501
International offset credits (post exchange)	0	0	966	0	1,320
Total domestic and international	0	0	1,252	0	1,821
Total emissions net of biosequestration and international reductions (mmt)	7,357	7,492	5,435	8,054	4,086
Cap and trade compliance summary (mmt)					
Allowances issued (cap)	n.a	5,086	5,086	3,554	3,554
Covered emissions, less offset credits	5,114	6,081	4,254	6,389	2,739
Net allowance bank change	0	0	833	0	815
Allowance bank balance	0	0	4,616	0	13,085
Allowance and offset prices ('07$s per mt CO2e)					
Emission allowance	0	0	31.7	0	64.8
Domestic offset	0	0	31.7	0	64.8
International offset	0	0	25.4	0	22.6
Delivered energy prices (including allowance cost after adjustment for free allocations, in '07$'s)					
Motor gasoline, transport (per gallon)	2.82	3.62	3.82	3.82	4.17
Jet fuel (per gallon)	2.17	3.02	3.28	3.33	3.8
Diesel (per gallon)	2.87	3.64	3.9	3.88	4.36
Natural gas (per thousand cubic feet)					
Residential	13.05	12.91	13.27	14.35	16.81
Electric power	7.22	7.22	8.52	8.57	10.44
Coal, electric power sector (per million Btu)	1.78	1.96	4.84	2.04	7.82
Electricity (cents per kilowatthour)	9.1	9.27	9.51	10.05	12.01
Energy consumption (quadrillion Btu)					
Liquid fuels	40.8	38.7	37.5	40.3	38.3
Natural gas	23.7	22.1	21.5	24.2	21.1
Coal	22.7	24.4	20.6	25.4	14
Nuclear power	8.4	9.1	9.8	9.3	16.2
Renewable/Other	6.3	10.4	12.2	11.8	14.9
Total	101.9	104.7	101.6	111	104.5
Purchased electricity	12.8	14.1	13.8	15.4	14.5
Electricity generation (billion kilowatthours)					
Petroleum	66	49	46	50	43
Natural gas	892	714	694	976	704
Coal	2,021	2,198	1,875	2,311	1,354
Nuclear power	806	876	940	890	1,548
Renewable/Other	374	736	907	827	1,048
Total	4,159	4,573	4,462	5,055	4,697

Source: DOE/EIA, *Energy Market and Economic Impacts of H.R. 2454, the American Clean Energy and Security Act of 2009*, and Management information Services, Inc., 2010.

In previous research conducted for DOE's National Energy Technology Laboratory (NETL) the MISI input-output model was used to provide industry

employment detail to the results of various NEMS model runs.[33] A similar application was conducted here using the MISI input-output model (see Appendix A) and simulated changes in the energy, environmental, and economic indicators from the Reference Case and the Basic Case.

First, all economic value indicators were converted from a 2000 constant dollar base to a 2007 constant dollar base where appropriate. Second, industry final demand was adjusted for the change in energy consumption between the two cases. For instance, in 2020, the volume consumption of liquid fuels and natural gas was three percent lower under the Basic Case and coal consumption was 15 percent lower. By 2030, the consumption of liquid fuels and natural gas was eight percent lower in the Basic Case and coal consumption was 45 percent lower. Finally, industry final demand was estimated using the adjusted final demand direct coefficients for consumption, investment, government spending, exports, imports, and inventory adjustments for both the Reference Case and the Basic Case.

The MISI input-output model is then used to estimate gross output, employment, personal income, and government taxes. In this case, the six final demand vectors were aggregated by industry for 2020 for both the Reference and the Basic Cases with the resulting GDP's totaling $18,450 billion (2007 constant dollars) and $18,390 billion, respectively. The estimated employment impacts by industry, in full-time equivalent units (FTE's) are listed in Table III-4.

Table III-4
Employment Impacts of ACESA Basic Case in 2020

Industry	Thousand	Industry	Percent
Apparel and leather and allied products	-6	Apparel and leather and allied products	-3.5%
Miscellaneous manufacturing	-4	Support activities for mining	-0.7%
Wholesale trade	-4	Oil and gas extraction	-0.4%
Support activities for mining	-3	Textile mills and textile product mills	-0.4%
Chemical products	-3	Mining, except oil and gas	-0.3%
Other transportation equipment	-3	Petroleum and coal products	-0.3%
Truck transportation	-2	Primary metals	-0.3%
Management of companies and enterprises	-2	Miscellaneous manufacturing	-0.3%
Motor vehicles, bodies and trailers, and parts	-2	Pipeline transportation	-0.2%
Other transportation and support activities	-2	Furniture and related products	-0.2%
Farms	-2	Forestry, fishing, and related activities	-0.2%
Primary metals	-2	Chemical products	-0.2%
Administrative and support services	-2	Air transportation	-0.2%
Textile mills and textile product mills	-2	Other transportation equipment	-0.2%
Federal Reserve banks and related activities	-2	Motor vehicles, bodies and trailers, and parts	-0.1%
Insurance carriers and related activities	-2	Paper products	-0.1%
Other services, except government	-2	Plastics and rubber products	-0.1%
Furniture and related products	-1	Wood products	-0.1%
Air transportation	-1	Management of companies and enterprises	-0.1%

[33]Management Information Services, Inc., *Development of Economic and Job Impacts Analysis Tool and Technology Deployment Scenario Analysis*, report prepared for the U.S. Department of Energy, National Energy Technology Laboratory, DOE/NETL-402/092509, September 2009.

Misc. professional, scientific and tech. services	-1	Nonmetallic mineral products	-0.1%
Food and beverage and tobacco products	-1	Warehousing and storage	-0.1%
Fabricated metal products	-1	Farms	-0.1%
Retail trade	-1	Truck transportation	-0.1%
Mining, except oil and gas	-1	Rental and leasing services	-0.1%
Plastics and rubber products	-1	Fabricated metal products	-0.1%
Computer and electronic products	-1	Wholesale trade	-0.1%
Forestry, fishing, and related activities	-1	Publishing industries (includes software)	-0.1%
Food services and drinking places	-1	Motion picture and sound recording industries	-0.1%
Paper products	-1	Rail transportation	-0.1%
Petroleum and coal products	-1	Computer and electronic products	-0.1%
Publishing industries (includes software)	-1	Other transportation and support activities	-0.1%
Legal services	-1	Printing and related support activities	0.0%
Wood products	-1	Food and beverage and tobacco products	0.0%
Nonmetallic mineral products	-1	Insurance carriers and related activities	0.0%
Securities, commodity contracts, and investments	-1	Information and data processing services	0.0%
Rental and leasing services	-1	Electrical equipment, appliances, and components	0.0%
Utilities	0	Federal Reserve banks and related activities	0.0%
Printing and related support activities	0	Securities, commodity contracts, and investments	0.0%
Warehousing and storage	0	Legal services	0.0%
Broadcasting and telecommunications	0	Utilities	0.0%
Real estate	0	Federal government enterprises	0.0%
Oil and gas extraction	0	Administrative and support services	0.0%
Motion picture and sound recording industries	0	Waste management and remediation services	0.0%
Electrical equipment, appliances, and components	0	Broadcasting and telecommunications	0.0%
Rail transportation	0	Misc. professional, scientific and tech. services	0.0%
Information and data processing services	0	State and local government enterprises	0.0%
Educational services	0	Other services, except government	0.0%
Performing arts, sports, and related activities	0	Performing arts, sports and related activities	0.0%
Accommodation	0	Real estate	0.0%
State and local government enterprises	0	Accommodation	0.0%
Machinery	0	Food services and drinking places	0.0%
Pipeline transportation	0	Machinery	0.0%
Waste management and remediation services	0	Educational services	0.0%
Ambulatory health care services	0	Retail trade	0.0%
Hospitals and nursing and residential care facilities	0	Amusements, gambling, and recreation industries	0.0%
Amusements, gambling, and recreation industries	0	Ambulatory health care services	0.0%
Federal government enterprises	0	Hospitals and nursing and residential care facilities	0.0%
Funds, trusts, and other financial vehicles	0	Funds, trusts, and other financial vehicles	0.0%
Social assistance	0	Social assistance	0.0%
Water transportation	0	State and local general government	0.0%
Transit and ground passenger transportation	0	Computer systems design and related services	0.0%
Computer systems design and related services	1	Federal general government	0.0%
Federal general government	1	Transit and ground passenger transportation	0.0%
State and local general government	3	Construction	0.1%
Construction	8	Water transportation	0.1%
Total Number	**-55**	**Percent of Employment**	**0.03%**

Source: Management Information Services, Inc., 2010.

Based on the 70-order industry level of detail, the national net employment impacts are estimated to be around 55,000 jobs lower under the Basic case, representing a 0.03 percent decrease in employment.

An identical analysis was conducted to estimate the 2030 impacts. The six final demand vectors were aggregated by industry for 2030 for both the Reference and the Basic Cases with the resulting GDP's totaling $23,814 billion (2007 constant dollars) and $23,621 billion, respectively. The estimated employment impacts by industry, in full-time equivalent units (FTE's) are listed in Table III-5.

Table III-5
Employment Impacts of ACESA Basic Case in 2030

Industry	Thousand	Industry	Percent
Apparel and leather and allied products	-51	Support activities for mining	-5.8%
Support activities for mining	-34	Apparel and leather and allied products	-4.4%
Wholesale trade	-32	Textile mills and textile product mills	-2.9%
Miscellaneous manufacturing	-30	Mining, except oil and gas	-2.4%
Chemical products	-25	Petroleum and coal products	-2.4%
Computer and electronic products	-25	Primary metals	-2.1%
Misc. professional, scientific and tech. services	-25	Miscellaneous manufacturing	-1.6%
Motor vehicles, bodies and trailers, and parts	-23	Furniture and related products	-1.2%
Truck transportation	-20	Motor vehicles, bodies and trailers, and parts	-1.1%
Administrative and support services	-20	Chemical products	-1.1%
Management of companies and enterprises	-19	Forestry, fishing, and related activities	-1.1%
Primary metals	-18	Computer and electronic products	-1.0%
Other transportation equipment	-17	Pipeline transportation	-1.0%
Fabricated metal products	-16	Oil and gas extraction	-1.0%
Other transportation and support activities	-15	Electrical equipment, appliances, and components	-0.8%
Farms	-14	Wood products	-0.8%
State and local general government	-14	Air transportation	-0.8%
Other services, except government	-13	Plastics and rubber products	-0.8%
Textile mills and textile product mills	-12	Paper products	-0.7%
Insurance carriers and related activities	-12	Other transportation equipment	-0.7%
Machinery	-12	Nonmetallic mineral products	-0.7%
Federal Reserve banks and related activities	-11	Fabricated metal products	-0.7%
Mining, except oil and gas	-11	Management of companies and enterprises	-0.6%
Furniture and related products	-10	Warehousing and storage	-0.5%
Plastics and rubber products	-9	Truck transportation	-0.5%
Air transportation	-9	Farms	-0.4%
Food and beverage and tobacco products	-8	Machinery	-0.4%
Petroleum and coal products	-7	Rail transportation	-0.4%
Electrical equipment, appliances, and components	-7	Wholesale trade	-0.4%
Forestry, fishing, and related activities	-6	Rental and leasing services	-0.4%
Legal services	-6	Printing and related support activities	-0.3%
Federal general government	-6	Motion picture and sound recording industries	-0.3%
Wood products	-6	Publishing industries (includes software)	-0.3%
Nonmetallic mineral products	-6	Other transportation and support activities	-0.3%
Paper products	-5	Insurance carriers and related activities	-0.3%
Broadcasting and telecommunications	-5	Food and beverage and tobacco products	-0.3%
Publishing industries (includes software)	-5	Misc. professional, scientific and tech. services	-0.3%
Food services and drinking places	-5	Information and data processing services	-0.2%
Printing and related support activities	-4	Waste management and remediation services	-0.2%
Securities, commodity contracts, and investments	-4	Legal services	-0.2%
Warehousing and storage	-4	Administrative and support services	-0.2%
Rental and leasing services	-4	Federal Reserve banks and related activities	-0.2%
Utilities	-4	Utilities	-0.2%
Retail trade	-4	Securities, commodity contracts, and investments	-0.2%

Real estate	-3	Broadcasting and telecommunications	-0.2%
Motion picture and sound recording industries	-3	Federal government enterprises	-0.1%
Rail transportation	-2	Federal general government	-0.1%
Performing arts, sports and related activities	-2	Other services, except government	-0.1%
Accommodation	-2	Performing arts, sports and related activities	-0.1%
Information and data processing services	-2	State and local government enterprises	-0.1%
State and local government enterprises	-2	State and local general government	-0.1%
Waste management and remediation services	-1	Accommodation	-0.1%
Educational services	-1	Real estate	-0.1%
Pipeline transportation	-1	Food services and drinking places	0.0%
Federal government enterprises	-1	Educational services	0.0%
Oil and gas extraction	0	Retail trade	0.0%
Amusements, gambling, and recreation industries	0	Amusements, gambling, and recreation industries	0.0%
Computer systems design and related services	0	Computer systems design and related services	0.0%
Funds, trusts, and other financial vehicles	0	Funds, trusts, and other financial vehicles	0.0%
Social assistance	0	Social assistance	0.0%
Water transportation	1	Ambulatory health care services	0.0%
Transit and ground passenger transportation	1	Hospitals and nursing and residential care facilities	0.0%
Ambulatory health care services	1	Transit and ground passenger transportation	0.1%
Hospitals and nursing and residential care facilities	2	Construction	0.1%
Construction	22	Water transportation	0.4%
Total Number	**-585**	**Percent of Employment**	**0.3%**

Source: Management Information Services, Inc., 2010.

Based on the 70-order industry level of detail, the national employment impacts are estimated to be a net loss of 585,000, a decrease of 0.3 percent in employment as shown in Table 4.

III.C.3. Scenario 3: High Technology Case

The ACESA High Technology (HT) Case, which achieves a 25 percent RPS, is similar to the ACESA Basic Case except that it incorporates the technology assumptions from the Integrated High Technology Case published in the *Annual Energy Outlook 2009* (AEO 2009).[34] This case illustrates the impact of more aggressive assumptions about technological improvements and their role in reducing GHG emissions.

In addition to the energy and environmental indicators, the HT Case also incorporates economic variable outputs from the National Energy Modeling System (NEMS). Those for 2009, 2020 and 2030 are summarized in Tables III-6 and III-7. Differences between the Reference Case and the HT Case are small but more pronounced than differences in the Reference and Basic Cases, and they also vary by time period:

- Real GDP is projected to increase an average of 2.7 percent per year over the 21 year period under both the Reference and the

[34]U.S. Energy Information Administration, op. cit.

High Technology cases, but GDP in the HT Case will be $61 billion lower by 2030 (’00 constant dollars)

- In contrast, real GDP is projected to be $9 billion higher under the High Technology Case in 2020 (’00 constant dollars) compared to the Reference Case, as most of the negative impacts to the economy occur in the second period, from 2020 to 2030
- Energy intensity is projected to decrease 2.4 percent per year under the HT Case, substantially more than the 2.1 percent decrease in the Reference case
- Energy prices to consumers are projected to increase moderately under the High Technology Case, reaching levels three percent higher in 2020 and 10 percent higher in 2030

Table III-6
EIA Economic Variables for Reference and High Technology Cases

	Reference			High Technology		
	2009	2020	2030	2009	2020	2030
Real Gross Domestic Product						
(billion '00 dollars, chain-weighted)	11,333	15,398	19,875	11,333	15,407	19,814
Components of Real GDP						
Real Consumption	8,163	10,817	14,069	8,163	10,817	14,018
Real Investment	1,331	2,591	3,590	1,331	2,591	3,547
Real Government Spending	2,100	2,229	2,473	2,100	2,238	2,461
Real Exports	1,378	2,862	4,865	1,378	2,859	4,872
Real Imports	1,678	2,942	4,719	1,678	2,948	4,700
Energy Intensity (thous. Btu per '00$ GDP)						
Delivered Energy	6.26	4.83	3.97	6.26	4.66	3.77
Total Energy	8.65	6.80	5.58	8.65	6.54	5.22
Price Indices						
GDP Chain-type Price Index (2000=1.000)	1.237	1.521	1.896	1.236	1.527	1.903
Consumer Price Index (1982-84=1.00)						
All-urban	2.12	2.79	3.58	2.12	2.80	3.61
Energy Commodities and Services	1.73	3.10	4.11	1.73	3.20	4.51
Wholesale Price Index (1982=1.00)						
All Commodities	1.65	2.12	2.47	1.65	2.16	2.59
Fuel and Power	1.43	2.66	3.62	1.43	2.82	4.13
Metals and Metal Products	1.68	2.10	2.18	1.68	2.11	2.20
Interest Rates (percent, nominal)						
Federal Funds Rate	0.15	5.40	5.00	0.15	5.36	4.87
10-Year Treasury Note	2.70	6.03	5.76	2.70	6.00	5.74
AA Utility Bond Rate	6.12	7.95	8.04	6.12	7.92	7.87
Population (millions)						
Population, with Armed Forces Overseas	308.4	342.6	374.7	308.4	342.6	374.7
Population, aged 16 and over	242.6	270.3	297.2	242.6	270.3	297.2
Population, over age 65	39.6	55.0	72.3	39.6	55.0	72.3
Key Labor Indicators						
Labor Force (millions)	153.5	166.4	175.6	153.5	166.4	175.3
Nonfarm Labor Productivity (1992=1.00)	1.42	1.75	2.17	1.42	1.75	2.17
Key Indicators for Energy Demand						
Housing Starts (millions)	0.60	1.99	1.77	0.60	2.00	1.74
Commercial Floorspace (billion square feet)	80.1	91.5	103.9	80.1	91.5	103.9
Unit Sales of Light-Duty Vehicles (millions)	10.26	18.09	19.69	10.27	18.06	19.43

Source: DOE/EIA, *Energy Market and Economic Impacts of H.R. 2454, the American Clean Energy and Security Act of 2009*, and Management Information Services, Inc., 2010.

Table III-7: Summary Results of ACESA Reference and High Technology Cases

2007	2020	2030

		Reference	High Tech	Reference	High Tech
Greenhouse gas emissions (mmt)					
Covered emissions					
Energy-related carbon dioxide	4,948	5,910	5,259	6,212	4,300
Other covered emissions	167	171	151	177	154
Total covered emissions	5,114	6,081	5,410	6,389	4,454
Noncovered emissions	2,242	1,411	1,392	1,665	1,627
Total greenhouse gas emissions	7,357	7,492	6,802	8,054	6,081
Offset credits (mmt)					
Noncovered gases	0	0	31	0	50
Biogenic sequestration	0	0	220	0	408
Total domestic offset credits	0	0	251	0	458
International offset credits (post exchange)	0	0	662	0	1,302
Total domestic and international	0	0	912	0	1,760
Total emissions net of biosequestration and international reductions (mmt)	7,357	7,492	5,755	8,054	4,045
Cap and trade compliance summary (mmt)					
Allowances issued (cap)	n.a	5,086	5,086	3,554	3,554
Covered emissions, less offset credits	5,114	6,081	4,498	6,389	2,694
Net allowance bank change	0	0	589	0	861
Allowance bank balance	0	0	3,649	0	12,680
Allowance and offset prices ('07$s per mt CO2e)					
Emission allowance	0	0	27.8	0	56.8
Domestic offset	0	0	27.8	0	56.8
International offset	0	0	22.2	0	22.5
Delivered energy prices (including allowance cost after adjustment for free allocations, in '07$'s)					
Motor gasoline, transport (per gallon)	2.82	3.62	3.77	3.82	4.12
Jet fuel (per gallon)	2.17	3.02	3.24	3.33	3.7
Diesel (per gallon)	2.87	3.64	3.84	3.88	4.24
Natural gas (per thousand cubic feet)					
Residential	13.05	12.91	13.01	14.35	16.13
Electric power	7.22	7.22	8.08	8.57	9.72
Coal, electric power sector (per million Btu)	1.78	1.96	4.43	2.04	6.96
Electricity (cents per kilowatthour)	9.1	9.27	9.15	10.05	11.32
Energy consumption (quadrillion Btu)					
Liquid fuels	40.8	38.7	37.3	40.3	37.9
Natural gas	23.7	22.1	21.1	24.2	20.3
Coal	22.7	24.4	19.8	25.4	12.3
Nuclear power	8.4	9.1	10.3	9.3	17
Renewable/Other	6.3	10.4	12.2	11.8	15.8
Total	101.9	104.7	100.8	111	103.4
Purchased electricity	12.8	14.1	13.6	15.4	14.1
Electricity generation (billion kilowatthours)					
Petroleum	66	49	46	50	42
Natural gas	892	714	645	976	593
Coal	2,021	2,198	1,802	2,311	1,154
Nuclear power	806	876	989	890	1,634
Renewable/Other	374	736	932	827	1,212
Total	4,159	4,573	4,481	5,055	4,830

Source: DOE/EIA, *Energy Market and Economic Impacts of H.R. 2454, the American Clean Energy and Security Act of 2009*, and Management Information Services, Inc., 2010.

An analysis similar to that conducted for the Basic Case analysis was conducted here using the MISI input-output model (see Appendix A), and changes in the energy,

environmental, and economic indicators from the Reference Case and the High Technology Case were estimated (Tables III-6 and III-7).

First, all economic value indicators were converted from a 2000 constant dollar base to a 2007 constant dollar base where appropriate. Second, industry final demand was adjusted for the change in energy consumption between the two cases. For instance, in 2020, the volume consumption of liquid fuels and natural gas was four percent lower under the High Technology Case and coal consumption was almost 20 percent lower. By 2030, the consumption of liquid fuels and natural gas was 10 percent lower in the High Technology Case and coal consumption was less than half the Reference Case. Finally, industry final demand was estimated using the adjusted final demand direct coefficients for consumption, investment, government spending, exports, imports, and inventory adjustments for both the Reference Case and the High Technology Case.

The MISI input-output model is then used to estimate gross output, employment, personal income, and government taxes. In this case, the six final demand vectors were aggregated by industry for 2020 for both the Reference and the High Technology Cases. The estimated employment impacts by industry, in full-time equivalent units (FTE's) are listed in Table III-8. Based on the 70-order industry level of detail, the national net employment impacts are estimated to be around 204 thousand jobs higher under the High Technology Case, representing a 0.1 percent gain in employment.

Table III-8
Employment Impacts of ACESA High Technology Case in 2020

Industry	Thousand	Industry	Percent
Support activities for mining	-36	Apparel and leather and allied products	-18.3%
Apparel and leather and allied products	-34	Support activities for mining	-8.2%
Miscellaneous manufacturing	-17	Petroleum and coal products	-3.0%
Other transportation equipment	-9	Mining, except oil and gas	-2.6%
Mining, except oil and gas	-9	Textile mills and textile product mills	-1.7%
Air transportation	-8	Miscellaneous manufacturing	-1.1%
Petroleum and coal products	-7	Pipeline transportation	-0.9%
Textile mills and textile product mills	-7	Air transportation	-0.9%
Management of companies and enterprises	-7	Furniture and related products	-0.9%
Chemical products	-6	Oil and gas extraction	-0.9%
Furniture and related products	-6	Forestry, fishing, and related activities	-0.7%
Truck transportation	-5	Primary metals	-0.6%
Farms	-5	Other transportation equipment	-0.6%
Primary metals	-4	Wood products	-0.4%
Wholesale trade	-3	Chemical products	-0.3%
Forestry, fishing, and related activities	-3	Paper products	-0.3%
Plastics and rubber products	-3	Nonmetallic mineral products	-0.3%
Wood products	-2	Management of companies and enterprises	-0.3%
Nonmetallic mineral products	-2	Plastics and rubber products	-0.3%
Paper products	-2	Farms	-0.2%
Other transportation and support activities	-1	Truck transportation	-0.2%
Rental and leasing services	-1	Warehousing and storage	-0.1%
Warehousing and storage	-1	Rental and leasing services	-0.1%

Oil and gas extraction	-1	Wholesale trade	-0.1%
Pipeline transportation	-1	Other transportation and support activities	0.0%
Food and beverage and tobacco products	0	Motion picture and sound recording industries	0.0%
Insurance carriers and related activities	0	Food and beverage and tobacco products	0.0%
Motion picture and sound recording industries	0	Insurance carriers and related activities	0.0%
Publishing industries (includes software)	0	Publishing industries (includes software)	0.0%
Funds, trusts, and other financial vehicles	0	Securities, commodity contracts, and investments	0.1%
Federal government enterprises	1	Legal services	0.1%
Rail transportation	1	Federal Reserve banks and related activities	0.1%
Information and data processing services	1	Utilities	0.1%
Waste management and remediation services	1	Printing and related support activities	0.1%
Printing and related support activities	1	Information and data processing services	0.1%
Securities, commodity contracts, and investments	1	Waste management and remediation services	0.1%
Water transportation	1	Administrative and support services	0.1%
Utilities	1	Rail transportation	0.1%
Legal services	1	Federal government enterprises	0.1%
State and local government enterprises	2	Real estate	0.2%
Performing arts, sports and related activities	3	Other services, except government	0.2%
Motor vehicles, bodies and trailers, and parts	3	State and local government enterprises	0.2%
Federal Reserve banks and related activities	4	Broadcasting and telecommunications	0.2%
Accommodation	4	Performing arts, sports and related activities	0.2%
Broadcasting and telecommunications	4	Accommodation	0.2%
Amusements, gambling, and recreation industries	4	Retail trade	0.2%
Fabricated metal products	4	Funds, trusts, and other financial vehicles	0.2%
Transit and ground passenger transportation	5	Food services and drinking places	0.2%
Real estate	6	Amusements, gambling, and recreation industries	0.2%
Electrical equipment, appliances, and components	6	Educational services	0.2%
Educational services	8	Motor vehicles, bodies and trailers, and parts	0.2%
Social assistance	9	Ambulatory health care services	0.2%
Administrative and support services	11	Hospitals and nursing and residential care facilities	0.2%
Federal general government	12	Social assistance	0.2%
Other services, except government	15	Fabricated metal products	0.3%
Ambulatory health care services	18	State and local general government	0.3%
Machinery	20	Federal general government	0.3%
Computer systems design and related services	21	Construction	0.3%
Food services and drinking places	21	Misc. professional, scientific and tech. services	0.4%
Computer and electronic products	24	Transit and ground passenger transportation	0.7%
Hospitals and nursing and residential care facilities	24	Computer systems design and related services	0.9%
Misc. professional, scientific and tech. services	28	Electrical equipment, appliances, and components	1.0%
State and local general government	33	Water transportation	1.1%
Retail trade	41	Machinery	1.1%
Construction	46	Computer and electronic products	1.3%
Total Impact	**204**	**Total Impact**	**0.1%**

Source: Management Information Services, Inc., 2010.

An identical analysis was conducted to estimate the 2030 impacts. The six final demand vectors were aggregated by industry for 2030 for both the Reference and the High Technology Cases. The estimated employment impacts by industry, in full-time equivalent units (FTE's) are listed in Table III-9. Based on the 70-order industry level of detail, the national employment impacts are estimated to be a net loss of 374,000, a decrease of 0.2 percent in employment.

Table III-9
Employment Impacts of ACESA High Technology Case in 2030

Industry	Thousand	Industry	Percent
Support activities for mining	-149	Oil and gas extraction	-45.6%
Construction	-59	Support activities for mining	-25.3%
State and local general government	-49	Petroleum and coal products	-11.4%
Apparel and leather and allied products	-48	Mining, except oil and gas	-8.9%
Mining, except oil and gas	-40	Apparel and leather and allied products	4.2%
Petroleum and coal products	-35	Pipeline transportation	-3.4%
Miscellaneous manufacturing	-24	Textile mills and textile product mills	-2.0%
Federal general government	-24	Furniture and related products	-1.6%
Management of companies and enterprises	-22	Miscellaneous manufacturing	-1.3%
Oil and gas extraction	-17	Nonmetallic mineral products	-1.0%
Wholesale trade	-17	Wood products	-1.0%
Furniture and related products	-13	Air transportation	-0.8%
Air transportation	-10	Management of companies and enterprises	-0.7%
Truck transportation	-10	Forestry, fishing, and related activities	-0.6%
Administrative and support services	-10	Warehousing and storage	-0.6%
Textile mills and textile product mills	-8	Primary metals	-0.6%
Nonmetallic mineral products	-8	Federal general government	-0.5%
Insurance carriers and related activities	-8	State and local general government	-0.4%
Wood products	-7	Rental and leasing services	-0.3%
Utilities	-5	Paper products	-0.3%
Primary metals	-5	Construction	-0.3%
Warehousing and storage	-5	Plastics and rubber products	-0.3%
Legal services	-5	Truck transportation	-0.2%
Forestry, fishing, and related activities	-4	Utilities	-0.2%
Plastics and rubber products	-4	Publishing industries (includes software)	-0.2%
Other transportation equipment	-4	Wholesale trade	-0.2%
Publishing industries (includes software)	-4	Insurance carriers and related activities	-0.2%
Federal Reserve banks and related activities	-4	Waste management and remediation services	-0.2%
Rental and leasing services	-4	Legal services	-0.2%
Paper products	-2	Information and data processing services	-0.2%
Pipeline transportation	-2	Other transportation equipment	-0.2%
Farms	-1	Printing and related support activities	-0.1%
Printing and related support activities	-1	Administrative and support services	-0.1%
Other transportation and support activities	-1	Federal Reserve banks and related activities	-0.1%
Information and data processing services	-1	Farms	0.0%
Waste management and remediation services	-1	Other transportation and support activities	0.0%
Other services, except government	-1	Other services, except government	0.0%
Food and beverage and tobacco products	0	Food and beverage and tobacco products	0.0%
Rail transportation	0	Rail transportation	0.0%
Broadcasting and telecommunications	0	Broadcasting and telecommunications	0.0%
Securities, commodity contracts, and investments	0	Securities, commodity contracts, and investments	0.0%
Funds, trusts, and other financial vehicles	0	Funds, trusts, and other financial vehicles	0.0%
Real estate	0	Real estate	0.0%
Performing arts, sports and related activities	0	Performing arts, sports and related activities	0.0%
Accommodation	0	Accommodation	0.0%
Federal government enterprises	0	Federal government enterprises	0.0%
State and local government enterprises	0	State and local government enterprises	0.0%
Motion picture and sound recording industries	1	Retail trade	0.0%
Amusements, gambling, and recreation industries	1	Amusements, gambling, and recreation industries	0.0%
Water transportation	2	Educational services	0.1%
Chemical products	4	Food services and drinking places	0.1%
Educational services	4	Misc. professional, scientific and tech. services	0.1%
Fabricated metal products	6	Social assistance	0.1%
Transit and ground passenger transportation	6	Ambulatory health care services	0.1%
Social assistance	6	Hospitals and nursing and residential care facilities	0.1%

Retail trade	8	Motion picture and sound recording industries	0.1%
Misc. professional, scientific and tech. services	11	Chemical products	0.2%
Food services and drinking places	11	Fabricated metal products	0.3%
Motor vehicles, bodies and trailers, and parts	12	Computer systems design and related services	0.6%
Electrical equipment, appliances, and components	13	Motor vehicles, bodies and trailers, and parts	0.6%
Ambulatory health care services	13	Transit and ground passenger transportation	0.6%
Computer systems design and related services	17	Water transportation	1.4%
Hospitals and nursing and residential care facilities	18	Machinery	1.7%
Machinery	43	Electrical equipment, appliances, and components	1.7%
Computer and electronic products	61	Computer and electronic products	2.5%
Total Number	**-374**	**Percent of Employment**	**-0.2%**

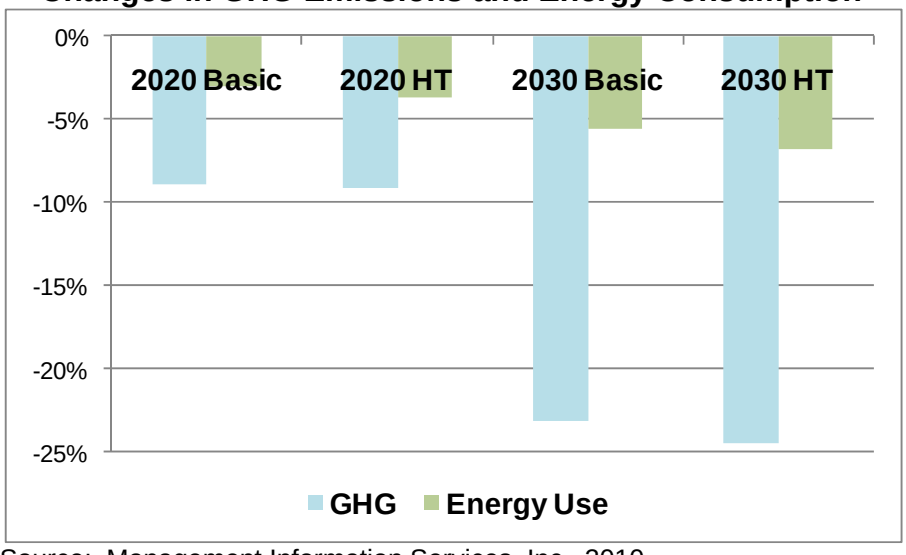
Source: Management Information Services, Inc., 2010.

III.D. Comparison and Assessment of Scenario Results

Figure III-2 shows changes in energy consumption and GHG emissions in 2020 and 2030 under Scenario 2, the Basic Case, and Scenario 3, the High Technology Case. This figure illustrates that compared to the reference case:

- In 2020 under Scenario 2, energy consumption decreases three percent and GHG emissions decrease 8.9 percent
- In 2020, under Scenario 3, energy consumption decreases 3.7 percent and GHG emissions decrease 9.2 percent
- In 2030 under Scenario 2, energy consumption decreases 5.6 percent and GHG emissions decrease 23 percent
- In 2030, under Scenario 3, energy consumption decreases 6.8 percent and GHG emissions decrease 25 percent

Figure III-2
Changes in GHG Emissions and Energy Consumption

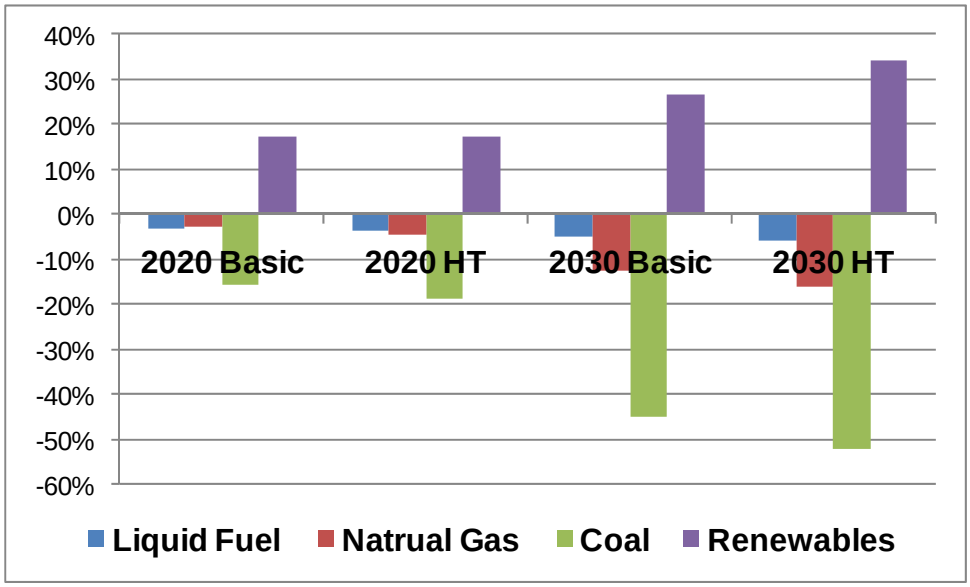


Source: Management Information Services, Inc., 2010.

Figure III-3 shows changes in energy fuels consumption in 2020 and 2030 under Scenario 2, the Basic Case, and Scenario 3, the High Technology Case. This figure illustrates that compared to the reference case:

- In 2020, under Scenario 2 liquid fuel consumption decreases 3.1 percent and decreases 3.6 percent under Scenario 3
- In 2020, under Scenario 2 natural gas consumption decreases 2.7 percent and decreases 4.5 percent under Scenario 3
- In 2020, under Scenario 2 coal consumption decreases 16 percent and decreases 19 percent under Scenario 3
- In 2020, under Scenario 2 renewables consumption increases 17 percent and increases 17 percent under Scenario 3
- In 2030, under Scenario 2 liquid fuel consumption decreases five percent and decreases six percent under Scenario 3
- In 2030, under Scenario 2 natural gas consumption decreases 13 percent and decreases 16 percent under Scenario 3
- In 2030, under Scenario 2 coal consumption decreases 45 percent and decreases 52 percent under Scenario 3
- In 2020, under Scenario 2 renewables consumption increases 26 percent and increases 34 percent under Scenario 3

Figure III-3
Changes in U.S. Energy Fuels Consumption

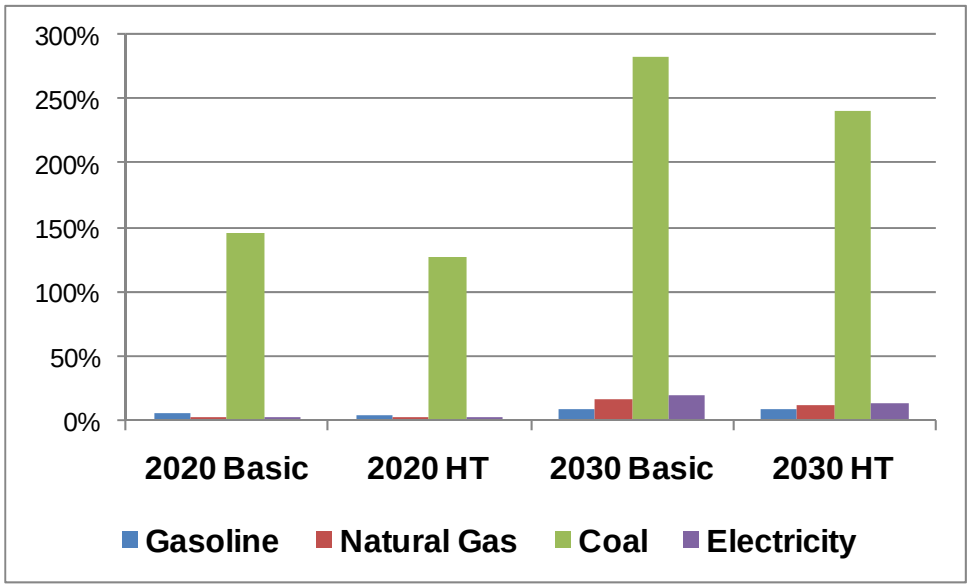


Source: Management Information Services, Inc., 2010.

Figure III-4 shows changes in energy prices in 2020 and 2030 under Scenario 2, the Basic Case, and Scenario 3, the High Technology Case. This figure illustrates that compared to the reference case:

- In 2020, under Scenario 2 gasoline prices increase 5.5 percent and increase 4.1 percent under Scenario 3
- In 2020, under Scenario 2 residential natural gas prices increase 2.3 percent and increase one percent under Scenario 3
- In 2020, under Scenario 2 coal prices to electric utilities increase 145 percent and increase 126 percent under Scenario 3
- In 2020, under Scenario 2 retail electricity prices increases 2.6 percent and increase 1.3 percent under Scenario 3
- In 2030, under Scenario 2 gasoline prices increase 9.2 percent and increase 7.8 percent under Scenario 3
- In 2030, under Scenario 2 residential natural gas prices increase 17 percent and increase 12 percent under Scenario 3
- In 2030, under Scenario 2 coal prices to electric utilities increase 283 percent and increase 241 percent under Scenario 3
- In 2030, under Scenario 2 retail electricity prices increases 20 percent and increase 13 percent under Scenario 3

Figure III-4
Changes in Energy Prices

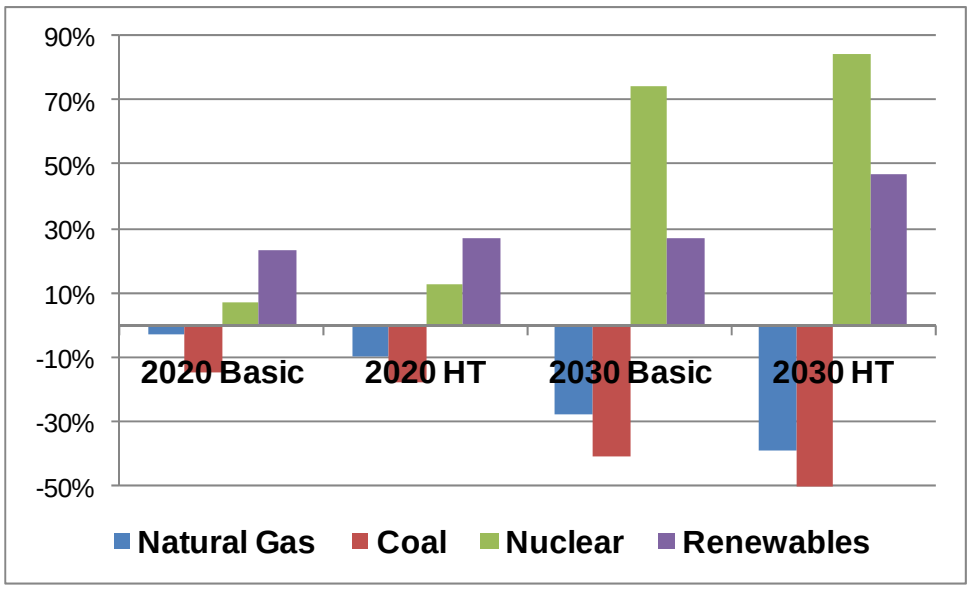


Source: Management Information Services, Inc., 2010.

Figure III-5 shows changes in fuel use for electricity production in 2020 and 2030 under Scenario 2, the Basic Case, and Scenario 3, the High Technology Case. This figure illustrates that, compared to the reference case, for electricity generation:

- In 2020, under Scenario 2 natural gas use decreases three percent and decreases 10 percent under Scenario 3
- In 2020, under Scenario 2 coal use decreases 15 percent and decreases 18 percent under Scenario 3
- In 2020, under Scenario 2 nuclear power increases seven percent and increases 13 percent under Scenario 3
- In 2020, under Scenario 2 renewables use increases 23 percent and increases 27 percent under Scenario 3
- In 2030, under Scenario 2 natural gas use decreases 28 percent and decreases 39 percent under Scenario 3
- In 2030, under Scenario 2 coal use decreases 41 percent and decreases 50 percent under Scenario 3
- In 2030, under Scenario 2 nuclear power increases 74 percent and increases 84 percent under Scenario 3
- In 2030, under Scenario 2 renewables use increases 27 percent and increases 47 percent under Scenario 3

Figure III-5
Change in Fuel Use For Electricity Production



Source: Management Information Services, Inc., 2010.

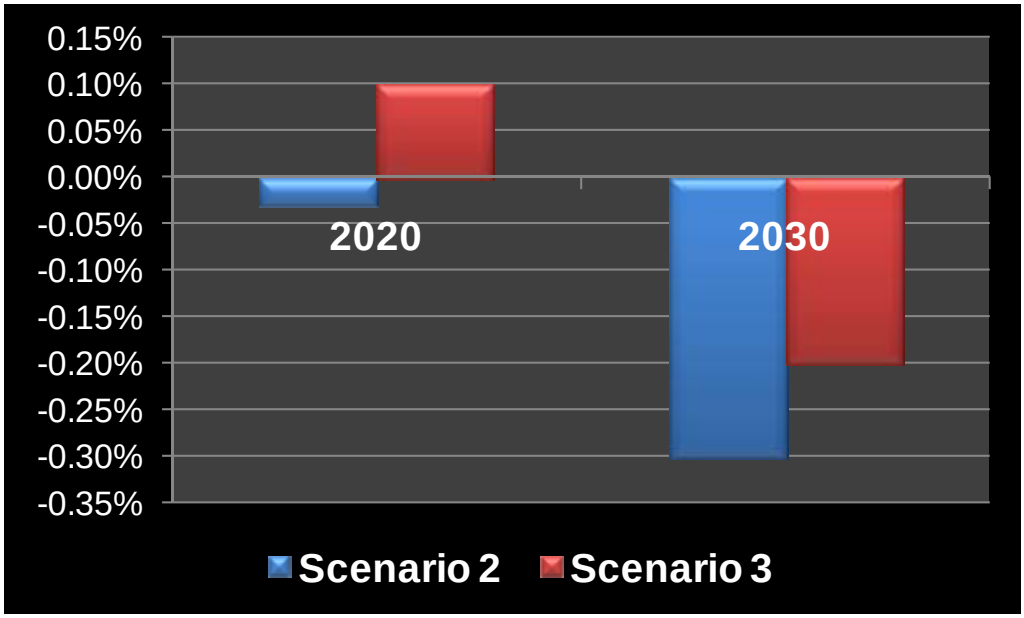
For all three scenarios, industry employment impacts at the 70-order North America Industrial Classification System (NAICS) were estimated.

Figure III-6 indicates that net employment changes little:

- In 2020, under Scenario 2 net employment decreases 0.03 percent and decreases 0.03 percent under Scenario 3
- In 2030, under Scenario 2 net employment decreases 0.1 percent and decreases 0.2 percent under Scenario 3

Further, the total net job changes of 300,000 to 600,000 are out of labor force of 175 million.

Figure III-6
Net Employment Change Under Each Scenario

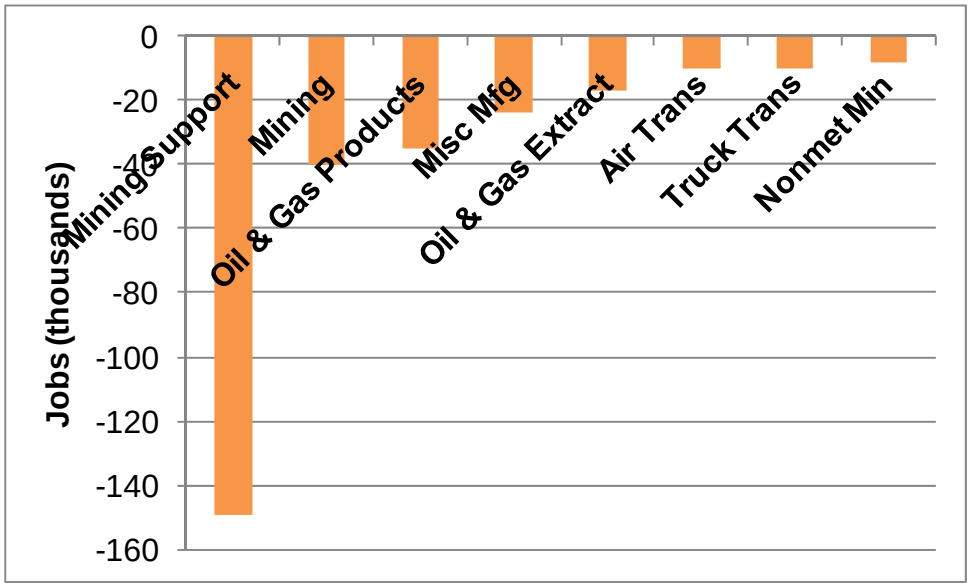


Source: Management Information Services, Inc., 2010.

Nevertheless, while the total net job losses will be very small, there will be significant job losses in some industries. For example, as shown in Figure III-7, in 2030 under Scenario 3:

- 149,000 jobs will be lost in the Mining Support Services industry
- 40,000 jobs will be lost in the Mining industry
- 35,000 jobs will be lost in the Petroleum and Coal Products industry
- 24,000 jobs will be lost in the Miscealleous Manufacturing industry
- 17,000 jobs will be lost in the Oil and Gas Extration industry
- 10,000 jobs will be lost in the Air Transportation industry
- 10,000 jobs will be lost in the Truck Transportation industry

Figure III-7
Job Losses in 2030 Under Scenario 3

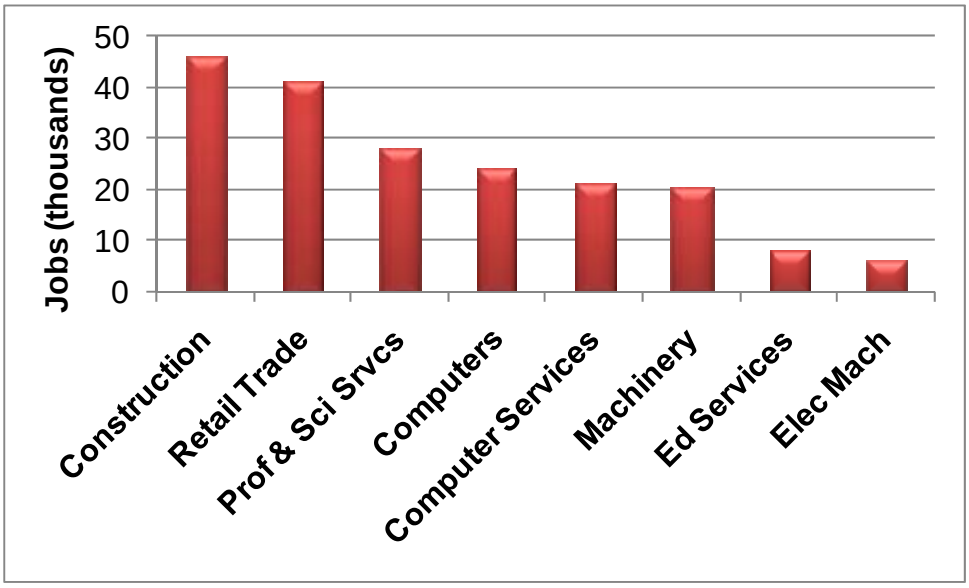


Source: Management Information Services, Inc., 2010.

Similarly, while the total net job losses will be very small, there will be significant job creation in some industries. For example, as shown in Figure III-8, in 2020 under Scenario 3:

- 46,000 jobs will be created in the Construction industry
- 41,000 jobs will be created in the Retail Trade industry
- 28,000 jobs will be created in the Professional and Scientific Services industry
- 24,000 jobs will be created in the Computer and electronic products industry
- 21,000 jobs will be created in the Computer Systems Design and Related Services industry
- 20,000 jobs will be created in the Machinery industry

Figure III-8
Job Creation in 2020 Under Scenario 3



Source: Management Information Services, Inc., 2010.

Thus, a major finding here is that, while the overall ACESA impact on net jobs will likely be very small, jobs in some industries will be lost. These industries include, depending on the scenario and year, those such as:

- Mining support activities
- Oil and gas extraction
- Chemical products
- Motor vehicles, bodies & parts
- Truck transportation
- Primary metals
- Miscellaneous transportation equipment
- Fabricated metal products
- Mining, except oil and gas
- Plastics and rubber products
- Air transportation
- Petroleum and coal products
- Electrical equipment, appliances, and components
- Nonmetallic mineral products

Similarly, while the overall ACESA impact on net jobs will likely be very small, jobs in some industries will be created. These industries include, depending on the scenario and year, those such as:

- Computer and electronic products
- Misc. professional, scientific and tech. services
- Information and data processing services
- Waste management and remediation services
- Retail trade
- Construction
- Rail transportation
- Water transportation
- Utilities
- Fabricated metal products
- Educational services
- Machinery
- Transit and ground passenger transportation
- Computer systems design and related services

More generally, we find that:

- Under reasonable assumptions, the total net job impact of ACESA is likely to be very small, perhaps less than 0.03 percent of the labor force
- This is true of the ACESA Basic Case (Scenario 2) and the more aggressive HT Case (Scenario 3)
- Our results are supported by findings of EIA, CBO, and EPA studies
- However, some industries – and the occupations concentrated in them – will be significantly affected, both positively and negatively
- Thus, an important finding here is that minimal total net job changes from ACESA may obscure large job losses and gains in some industries

IV. EMPLOYMENT EFFECTS OF THE ENERGY-INTENSIVE TRADE-EXPOSED INDUSTRIES PORTIONS OF ACESA

IV.A. The Issue of Energy-Intensive Trade-Exposed Industries

Concerns over the potential impacts of ACESA on the competitiveness of U.S. industries induced lawmakers to include relief provisions for certain energy-intensive trade-exposed (EITE) industries in ACESA. There is a possibility that a cap on U.S. industrial sectors could provide a comparative advantage for industries in uncapped countries, leading to loss of competitive advantage that would cause a migration of U.S. manufacturing to uncapped competitor countries. Further, the shifting of economic activity to uncapped countries could generate a corresponding increase in uncapped countries' GHG emissions -- emissions leakage, thus undermining the efforts of the U.S. and other countries that do adopt a cap.[35]

ACESA includes two provisions that address competitiveness concerns:

- A program for freely allocating a number of emission allowances to qualifying EITE industries[36]
- An import allowance requirement, that would take effect in 2020, if major emitting competitors do not agree to binding commitments of their own[37]

Beginning with the enactment of legislation, ACESA reserves a number of allowances from the total allowance pool for EITE industries, starting at two percent of available allowances in 2012 and 2013, rising to 15 percent in 2014 to coincide with the capping of industrial manufacturer emissions, and then slowly declining to zero percent by 2035. The total number of emission allowances freely distributed to EITEs cannot exceed the pool of reserved EITE allowances.

IV.B. EITE Industries

Through its requirement that firms acquire and submit allowances to cover their GHGs, a cap-and-trade program like that incorporated in ACESA will tend to have more significant effects on an industry the more emission-intensive that industry is. While some industries have significant GHGs associated with manufacturing processes that do not involve fuel combustion, most manufacturing emissions are associated with energy use. As a result, the more energy-intensive an industry is, the more emission-

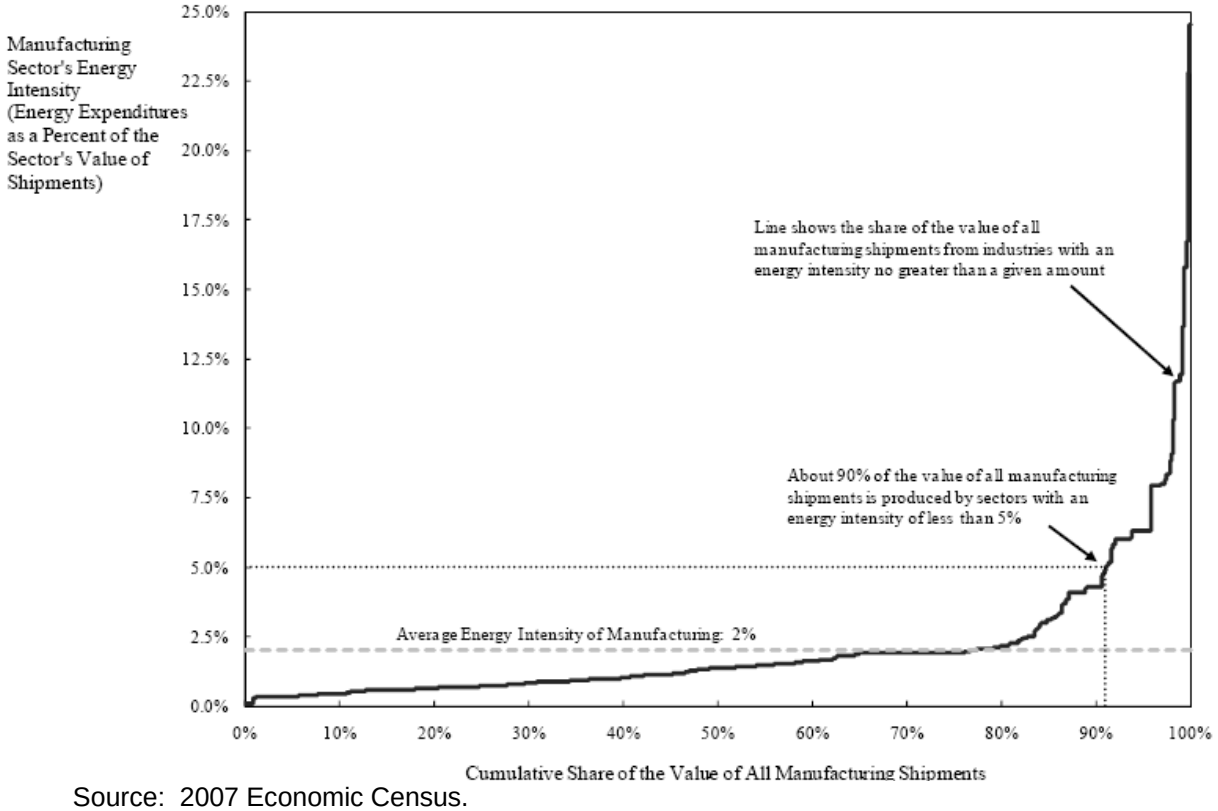
[35]See the discussion in Joshua Schneck, Brian Murray, Jan Mazurek, and Gale Boyd, "Protecting Energy-Intensive Trade-Exposed Industry," Nicholas Institute Discussion Memo on H.R. 2454, American Clean Energy and Security Act of 2009, Duke University, October 5, 2009.

[36]Free allowances can help counter economic risks to U.S. industries that simultaneously incur high energy input costs and compete directly in global markets where major competitors are uncapped (e.g., iron and steel, aluminum, cement, glass, and paper).

[37]Free allowances can help to counter economic risks to U.S. industries that simultaneously incur high energy input costs and compete directly in global markets where major competitors are uncapped (e.g., iron and steel, aluminum, cement, glass, and paper).

intensive it is, and the more it will likely be affected by a C&T program. On the whole, energy expenditures equal only about two percent of the value of U.S. manufacturing's output (Figure IV-1) and three-quarters of all manufacturing output is from industries with energy expenditures below two percent of the value of their output. Thus, the vast majority of U.S. industry will be relatively unaffected by a GHG cap-and-trade program. Industries whose energy expenditures exceed five percent of the value of their output -- a threshold given significance in ACESA -- account for only one-tenth of the value of U.S. manufacturing output, and less than two percent of U.S. GDP. Thus, while concerns have been expressed about a C&T program's impacts on U.S. manufacturing, it is important to recognize that these concerns apply only to a small subset of manufacturers, and thereby call for narrowly and carefully targeted policies. ACESA establishes specific criteria that industries must meet to be eligible for the provisions that are intended to address emission leakage associated with impacts on international competitiveness.

Figure IV-1
Energy Intensity of U.S. Manufacturing Sectors in 2007



Source: 2007 Economic Census.

IV.B.1. Identifying EITE Industries

In the course of establishing provisions to address emission leakage associated with the international competitiveness impacts of a domestic C&T program, ACESA establishes criteria for identifying energy-intensive trade-exposed industries. Specifically, ACESA considers an industry to be "presumptively eligible" for emission allowance allocations (rebates) to "trade-vulnerable" industries if the industry's energy intensity or its GHG intensity is at least five percent, and its trade intensity is at least 15 percent.[38] In addition, ACESA considers an industry to be "presumptively eligible" if its energy or greenhouse gas intensity is at least 20 percent, regardless of its trade intensity.[39]

EPA developed a preliminary assessment of the sectors that would likely be deemed "presumptively eligible" for allowance allocations to "trade-vulnerable" industries under ACESA. However, recent updates to key data sources have allowed EPA to revise that preliminary assessment.[40] Table IV-1 presents the set of six-digit industries that would likely be deemed "presumptively eligible" for allocations under ACESA based on EPA's updated preliminary assessment. For each industry, this table also presents estimates of the industry's emissions as well as relevant economic characteristics, such as employment, output, energy intensity, greenhouse gas intensity, and trade intensity. The final determination of "presumptively eligible" industries would be made in a formal EPA rulemaking upon enactment of legislation, and the emission estimates in Table IV-1 are intended to give a sense of the overall scale of the industries' recent emissions and would not be used for eligibility determinations or allocations.

[38]An industry's energy intensity is defined as its energy expenditures as a share of the value of its domestic production. An industry's greenhouse gas intensity is defined as its total greenhouse gas emissions (including indirect emissions from electricity consumption) times $20 per ton of emissions, divided by the value of the industry's domestic production. An industry's trade intensity is defined as the combined value of its exports and imports as a share of the value of its domestic production and imports.

[39]ASCEA identified the specific data sources that should be relied on in assessing industry eligibility. These include the Census Bureau's Annual Survey of Manufactures and Economic Census, the EIA Manufacturing Energy Consumption Survey, and data from the U.S. International Trade Commission. The bill also requires that, to the extent feasible, eligibility assessments should be conducted at the most disaggregated level for which the necessary public data are available -- the six-digit industry classification under the North American Industry Classification System (NAICS). NAICS is the standard classification system used by federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. economy. The most detailed public data on the production and operation of manufacturing facilities is provided at a six-digit industry classification level. Within manufacturing, there are nearly 500 six-digit sectors. Classifications with fewer digits (e.g., at the four-digit level) aggregate these six-digit sectors into more broadly defined sectors.

[40]For example, relevant data from the 2007 Economic Census and EIA's 2006 Manufacturing Energy Consumption Survey were released later in 2009.

Table IV-1: Preliminary Assessment of Industries Likely to Be Deemed "Presumptively Eligible" for Allowance Rebates under Section 401 of ACESA

NAICS Code and Title(1)	2007 Economic Statistics(2)			Eligibility Determination		2006 Emissions (MMTCO2e)(5)				
	Value of Shipments ($1,000)	Employ-ees	Establish-ments	Energy Intensity(3)	Trade Intensity(4)	Direct Combus-tion Emissions	Process Emis-sions	Indirect Electricity Emis-sions	Total Emis-sions	GHG Intensity at $20 pe Ton of CO2e(6)
311213: Malt manufacturing	786,571	1,022	25	9%	30%	0.8	0.0	0.3	1.0	2.6%
311221: Wet Corn Milling	12,117,145	8,448	64	10%	19%	12.1	0.0	4.3	16.4	3.3%
311613: Rendering and Meat Byproduct Processing	3,563,862	9,355	228	8%	28%	3.5	0.0	0.7	4.2	2.3%
313111: Yarn Spinning Mills	5,011,244	24,750	249	5%	32%	0.4	0.0	2.9	3.3	1.3%
314992: Tire Cord and Tire Fabric Mills	1,069,765	3,577	22	5%	35%	0.2	0.0	0.6	0.8	1.4%
321219: Reconstituted Wood Product Manufacturing	6,896,468	20,426	262	7%	38%	2.7	0.0	4.1	6.8	1.7%
322110: Pulp Mills	5,027,395	7,268	39	8%	90%	2.7	0.0	1.1	3.8	1.8%
322121: Paper (except Newsprint) Mills(7)	46,291,440	75,921	241	8%	17%	29.3	0.0	14.6	44.0	1.9%
322122: Newsprint Mills	3,440,645	4,917	21	16%	68%	2.7	0.0	6	8.7	5.1%
322130: Paperboard Mills(7)	25,354,745	36,641	187	12%	25%	19.3	0.0	14	33.3	2.9%
325110: Petrochemical Manufacturing	77,661,772	9,257	56	6%	17%	48.5	0.7	3	52.2	1.6%
325131: Inorganic Dye and Pigment Manufacturing	5,689,517	7,606	96	6%	43%	2.5	0.0	1.8	4.4	1.5%
325181: Alkalies and Chlorine Manufacturing (incl soda ash beneficiation)	6,370,780	6,364	49	24%	29%	7.8	4.2	3.9	16.0	5.0%
325182: Carbon Black Manufacturing	1,487,557	1,591	32	7%	26%	0.7	3.0	0.4	4.1	5.4%
325188: All Other Basic Inorganic Chemical Manufacturing	22,828,592	35,801	631	8%	58%	7.3	5.1	15.4	27.8	2.9%
325192: Cyclic Crude and Intermediate Manufacturing	5,947,517	3,006	31	5%	102%	1.8	0.0	1.7	3.5	1.2%
325199: All Other Basic Organic Chemical Manufacturing	81,997,462	70,602	818	6%	49%	34.4	5.9	13.7	54.0	1.3%
325211: Plastics Material and Resin Manufacturing	85,231,585	71,216	1,059	5%	38%	28.1	0.0	12.2	40.3	1.0%
325212: Synthetic Rubber Manufacturing	8,253,660	9,794	152	5%	57%	2.4	0.0	1.1	3.6	1.0%
325221: Cellulosic Organic Fiber Manufacturing	925,820	1,353	15	7%	90%	0.7	0.0	0.2	0.9	1.9%
325222: Noncellulosic Organic Fiber Manufacturing	6,963,293	14,684	109	5%	40%	4.4	0.0	3.2	7.6	2.2%
325311: Nitrogenous Fertilizer Manufacturing	5,524,151	3,920	156	14%	83%	6.4	30.5	1.5	38.4	18.5%
327111: Vitreous China Plumbing Fixture and China and Earthenware Bathroom Accessories	867,553	4,825	30	5%	60%	0.7	0.0	0.1	0.9	1.8%
327112: Vitreous China, Fine Earthenware, and Other Pottery Product Manufacturing	783,594	8,774	664	5%	94%	0.5	0.0	0.1	0.7	1.4%
327113: Porcelain Electrical Supply Manufacturing	737,282	4,465	113	5%	41%	0.4	0.0	0.3	0.7	1.3%
327122: Ceramic Wall and Floor Tile Manufacturing	1,126,093	6,272	183	7%	69%	1.1	0.0	0.3	1.4	2.4%
327123: Other Structural Clay Product Manufacturing	243,009	1,650	54	10%	27%	0.4	0.0	0	0.4	3.5%
327125: Nonclay Refractory Manufacturing	1,372,439	5,338	101	6%	46%	0.9	0.0	0.3	1.1	1.7%
327211: Flat Glass Manufacturing	3,420,860	10,991	93	16%	51%	2.9	0.1	1.1	4.2	2.5%
327212: Other Pressed and Blown Glass and Glassware Manufacturing	4,316,979	21,189	524	11%	58%	4.1	0.1	3.2	7.4	3.7%
327213: Glass Container Manufacturing	4,899,025	14,928	74	14%	21%	2.7	0.1	2.4	5.3	2.4%
327310: Cement Manufacturing	10,619,945	17,749	302	15%	19%	31	46.6	7.7	85.3	15.9%
327410: Lime Manufacturing	1,875,567	4,369	83	23%	4%	10.4	15.1	0.9	26.4	33.0%
327992: Ground or Treated Mineral and Earth Manufacturing	2,826,839	6,497	258	9%	17%	3.1	0.0	1	4.1	3.0%
327993: Mineral Wool Manufacturing	6,147,076	18,891	307	8%	18%	2.2	0.0	2.6	4.8	1.5%
331111: Iron and Steel Mills(8)	102,186,442	114,315	743	6%	33%	101.3	0.0	32.8	134.1	2.6%
331112: Electrometallurgical Ferroalloy Product Manufacturing	1,319,541	2,144	20	11%	77%	0.5	1.5	2.1	4.0	6.1%
331210: Iron and Steel Pipe and Tube Manufacturing from Purchased Steel(8)	8,637,314	17,408	153	2%	N/A	1.4	0.0	1.2	2.6	0.6%
331311: Alumina Refining	1,337,014	1,611	16	21%	70%	2.3	6.7	24.3	33.4	9.0%
331312: Primary Aluminum Production	6,657,285	9,355	54	22%	64%	Emissions and GHG Intensity Reflected in Alumina Refining				
331411: Primary Smelting and Refining of Copper(9)	8,247,767	1,771	13	2%	55%	1	0.0	0.3	1.3	0.3%
331419: Primary Smelting and Refining of Nonferrous Metal (except Copper and Aluminum)	5,987,185	8,067	183	7%	135%	1.1	0.8	3.8	5.7	1.9%
331511: Iron Foundries	11,795,934	51,503	470	6%	15%	4	0.0	5.4	9.4	1.6%
335991: Carbon and Graphite Product Manufacturing	2,795,262	8,666	143	6%	52%	0.7	0.0	1	1.7	1.4%
212210: Iron Ore Mining	2,955,254	4,989	22	11%	38%	6.3	0.0	4.4	10.7	7.3%
212234: Copper Ore and Nickel Ore Mining(9)	8,985,692	10,384	31	6%	12%	6.7	0.0	3.2	9.9	2.2%
TOTALS	618,581,937	783,670	9,176	-	-	405	120.0	205	730.0	-

1. This table updates previous EPA analysis (released June 10, 2009) with recently released data, including the 2007 Economic Census and 2006 Manufacturing Energy Consumption Survey. This does not represent a final EPA determination and the emissions estimates presented here will not be used tomake any allocation determinations. The methodology is detailed in a separate EPA memorandum available upon request.

2. While these statistics reflect 2007 data, the energy, greenhouse gas, and trade intensities presented to the right are typically based on data from earlier years, as required in H.R. 2454 and described in the above-referenced memorandum.

3. Energy intensity is equal to a sector's energy expenditures divided by its value of shipments. The specific calculations and sources of relevant data are detailed in the above-referenced memorandum.

4. Trade intensity is equal to the sum of the value of a sector's imports and exports, divided by the sum of its value of shipments and imports. The specific calculations and sources of relevant data are detailed in the above-referenced memorandum.

5. The Energy Information Administration's 2006 Manufacturing Energy Consumption Survey was used to estimate direct combustion emissions and indirect electricity emissions from 25 industries that account for 90% of the total estimated direct combustion and indirect electricity emissions of the presumptively eligible industries. The remaining emissions estimates are based on EPA analysis that relies on several data sources. All process emissions estimates are derived from EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2007 . Given data limitations, emissions estimates for 10 sectors (with total estimated emissions of 43 MMTCO2e) reflect estimates of 2007, rather than 2006, emissions. The above-referenced memorandum provides additional details regarding emissions estimation methods.

6. As called for in H.R. 2454, greenhouse gas intensity is calculated by monetizing an industry's emissions at a price of $20 per ton of carbon dioxide equivalent, and dividing this value by the industry's value of shipments.

7. The U.S. Census Bureau recently adjusted the classifications that it employs in assigning imports and exports to the paper and paperboard industries, and will report revised data beginning with 2009. The trade intensities reported here reflect EPA's preliminary analysis of how this adjustment would affect eported trade data in prior years. The above-referenced memorandum provides additional details regarding the methodology employed to determine the trade intensity of these sectors.

8. Iron and steel mill process emissions are included in the "Direct Combustion" estimate due to the nature of the data collection and reporting by the Manufacturing Energy Consumption Survey. The above-referenced EPA memorandum provides additional details explaining this categorization.

9. On their own, these sectors do not meet either the energy or trade intensity thresholds specified in the bill, but are expected to be eligible based on other language in the bill. The above-referenced memorandum provides additional details regarding eligibility determination for these sectors.

Source: *Interagency Report*, February 2010, and Management Information Services, Inc., 2010.

Table IV-1 shows the 46 six-digit NAICS sectors identified by House Energy and Commerce committee staff, using data provided by EPA, that meet qualifying criteria for EITE allowance eligibility.[41] Most sectors involve primary materials processing (i.e., glass, cement, steel, aluminum, or bulk chemical manufacturing), but the variety of products and manufacturing processes, and associated energy and GHG emissions, that can fall within a single qualifying six-digit NAICS code may be considerable.

According to the preliminary assessment of the nearly 500 six-digit NAICS manufacturing industries, 44 would be deemed "presumptively eligible" for allowance rebates under ACESA. Of these, 12 are in the chemicals sector, four are in the paper sector, 13 are in the nonmetallic minerals sector (e.g., cement and glass manufacturers), and eight are in the primary metals sector (e.g., aluminum and steel manufacturers). Many of these sectors are at or near the beginning of the value chain, and provide the basic materials needed for manufacturing advanced technologies. In addition to these 44 industries, the processing subsectors of several mineral industries are also likely to be deemed "presumptively eligible." In total, in 2007, the "presumptively eligible" industries accounted for 12 percent of total manufacturing output and employed about 780,000 workers, or about six percent of manufacturing employment and ½ of one percent of total U.S. non-farm employment. As Figure IV-2 indicates, most industrial sectors have energy intensities of less than five percent, and will therefore have minimal direct exposure to a climate policy's economic impacts.

IV.B.2. EITE Industries Emissions and Employment

While accounting for a relatively small share of manufacturing output and employment, the "presumptively eligible" industries' GHGs totaled about 730 million metric tons of carbon dioxide equivalent ($MMTCO_2e$) in 2006 (the most recent year for which key data sources are available), or about half of U.S. manufacturing greenhouse gas emissions and 10 percent of total U.S. emissions in that year.[42] In turn, relatively few industries account for the bulk of the "presumptively eligible" industries' emissions. The top five industries on an emissions basis (iron and steel, cement, other basic organic chemicals, petrochemicals, and paper mills) account for about half of the "presumptively eligible" industries' emissions, and the top ten industries account for three-quarters of those emissions.

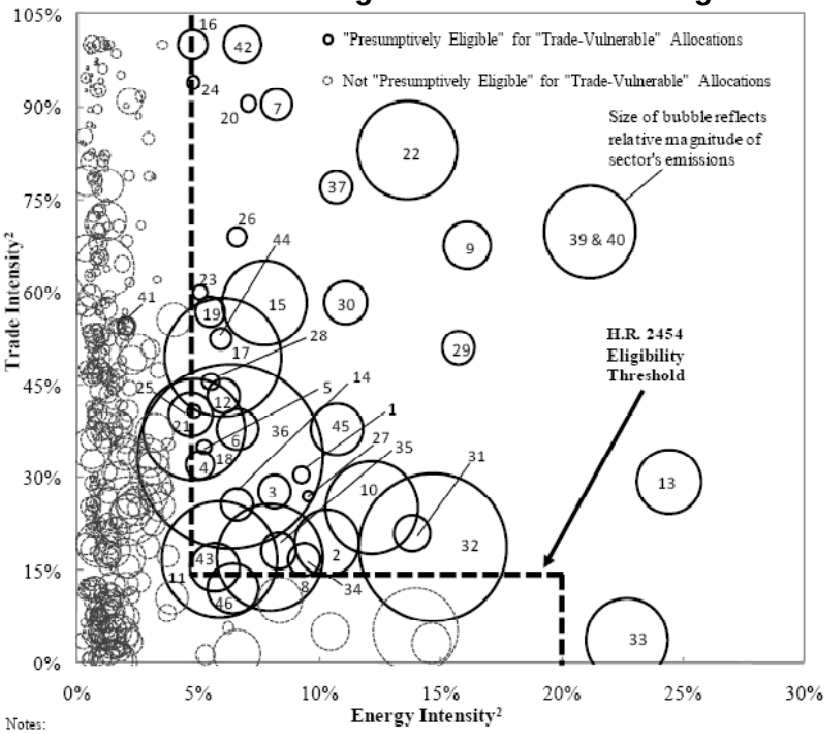
The emissions estimates given in Table IV-1 are based on data from the Manufacturing Energy Consumption Survey, the Annual Survey of Manufactures, the Economic Census, EPA, and the Bureau of Economic Analysis. While these data provide the best available estimates of recent emissions, there is considerable uncertainty as to what the emissions of the "presumptively eligible" industries will be in

[41] Eligible sectors must meet an energy or GHG intensity threshold of five percent and a trade intensity of 15 percent, or a very high energy or GHG intensity of 20 percent.

[42] Carbon dioxide equivalent is a measure of emissions that expresses non-CO_2 GHGs in terms of the number of tons of CO_2 that would have the same global warming potential over a given timeframe as those non-CO_2 emissions.

2014, when they would first be directly covered by the cap-and-trade program proposed in ACESA.

Figure IV-2
Energy Intensity, Trade Intensity, and Emissions of U.S. Manufacturing Sectors at the Six-Digit NAICS Code Level[1]



1. Malt Manufacturing (311213)
2. Wet Corn Milling (311221)
3. Rendering and Meat Byproduct Processing (311613)
4. Yarn Spinning Mills (313111)
5. Tire Cord and Tire Fabric Mills (314992)
6. Reconstituted Wood Product Manufacturing (321219)
7. Pulp Mills (322110)
8. Paper (except Newsprint) Mills (322121)
9. Newsprint Mills (322122)
10. Paperboard Mills (322130)
11. Petrochemical Manufacturing (325110)
12. Inorganic Dye and Pigment Manufacturing (325131)
13. Alkalies and Chlorine Manufacturing (325181)
14. Carbon Black Manufacturing (325182)
15. All Other Basic Inorganic Chemical Mfg. (325188)
16. Cyclic Crude and Intermediate Manufacturing (325192)
17. All Other Basic Organic Chemical Mfg. (325199)
18. Plastics Material and Res in Manufacturing (325211)
19. Synthetic Rubber Manufacturing (325212)
20. Cellulosic Organic Fiber Manufacturing (325221)
21. Noncellulosic Organic Fiber Manufacturing (325222)
22. Nitrogenous Fertilizer Manufacturing (325311)
23. Vitr. China Plumbing Fixture and Other Mfg. (327111)
24. Vitreous China and Other Pottery Mfg. (327112)
25. Porcelain Electrical Supply Manufacturing (327113)
26. Ceramic Wall and Floor Tile Manufacturing (327122)
27. Other Structural Clay Product Manufacturing (327123)
28. Nonclay Refractory Manufacturing (327125)
29. Flat Glass Manufacturing (327211)
30. Other Pressed/Blown Glass and Glsswr. Mfg. (327212)
31. Glass Container Manufacturing (327213)
32. Cement Manufacturing (327310)
33. Lime Manufacturing (327410)
34. Ground or Treated Mineral and Earth Mfg. (327992)
35. Mineral Wool Manufacturing (327993)
36. Iron and Steel Mills (331111)
37. Electrometallurgical Ferroalloy Product Mfg. (331112)
38. Iron/Steel Pipe/Tube Mfg. from Purchsd. Steel (331210)
39. Alumina Refining (331311)
40. Primary Aluminum Production (331312)
41. Primary Smelting and Refining of Copper (331411)
42. Smltg./Rfg. of Nonfrs. Mtl. (ex. Cpr. and Almn.) (331419)
43. Iron Foundries (331511)
44. Carbon and Graphite Product Manufacturing (335991)
45. Iron Ore Mining (212210)
46. Copper Ore and Nickel Ore Mining (212234)

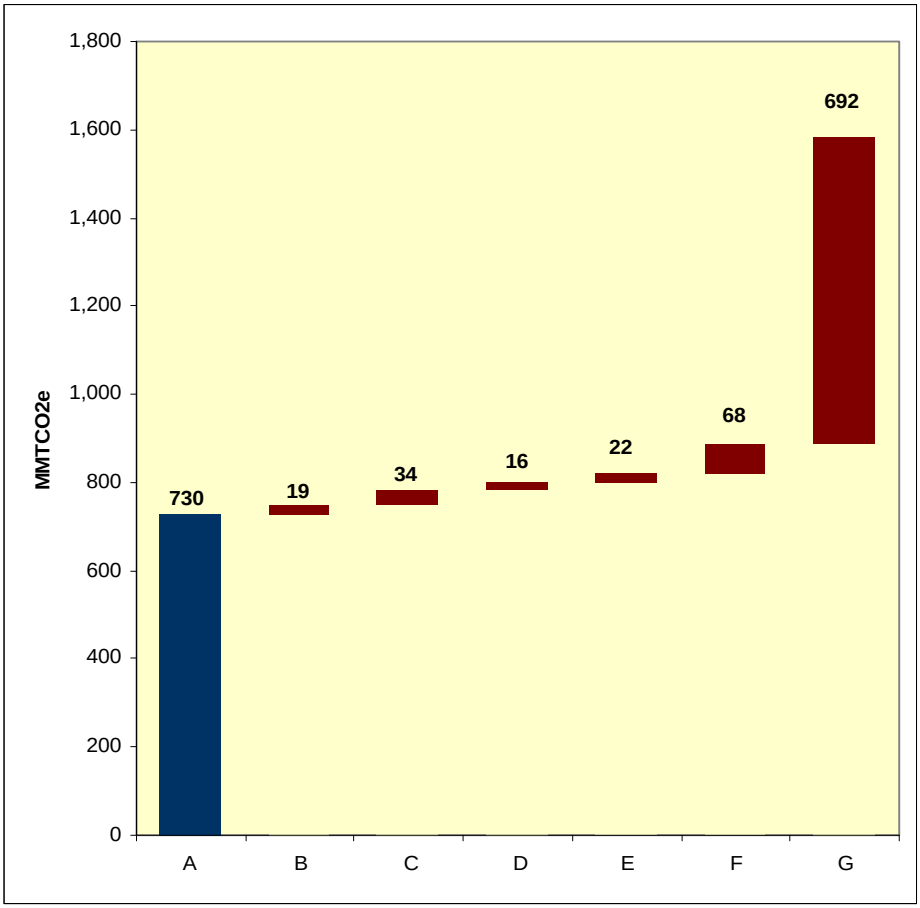
Notes:
1. Petroleum refining is not depicted because it is explicitly excluded from H.R. 2454's allocations to "trade-vulnerable" industries. Also, 91 other sectors, with 130 $MMTCO_2e$ of emissions, are not depicted due to lack of trade intensity data. One of these, iron and steel pipe and tube manufacturing from purchased steel (331210; 2.6 $MMTCO_2e$) is expected to be eligible based on language in the bill. Four others meet the energy-intensity threshold, each with 2 to 3 $MMTCO_2e$ of emissions: beet sugar manufacturing, broadwoven fabric finishing mills, steel foundries (except investment), and metal heat treating. Twelve sectors with a calculated trade intensity greater than 100% are depicted here with an intensity of 100% (the maximum possible intensity). The two copper sectors (212234 and 331411) do not meet the energy or trade intensity thresholds specified in H.R. 2454 but are expected to be eligible based on other language in the bill.
2. Energy intensity and trade intensity measures are as defined in H.R. 2454 and elsewhere in this report.
Source: EPA analysis.

Over time, the emission intensity of these industries' production processes is expected to continue to decline as new technology emerges and investments in energy efficiency continue to be made, exerting downward pressure on emissions. At the same time, increases in manufacturing activity in key sectors could have a countervailing effect on emissions. ACESA allows for the administrative determination of eligibility for additional sectors based on changes in international trade patterns and based on "individual showings," whereupon industries and subsectors of industries can petition for eligibility.

Figure IV-3 summarizes the emissions of all manufacturing industries, aggregating those not deemed "presumptively eligible" into various categories of trade and energy intensity, and it offers insight into the quantity of emissions associated with certain industries or subsectors that might ultimately be deemed eligible for allowance rebates. For example, there are about 19 $MMTCO_2e$ of emissions associated with

those industries that meet the five percent energy intensity threshold but have trade intensities that are either between 10 and 15 percent, or are not reported in government trade databases.[43] On the other hand, the vast majority of manufacturing's remaining emissions are in industries with energy intensities well below the five percent threshold. It is thus unlikely that subsequent eligibility determinations, such as those arising from "individual showings," would dramatically affect the scope of emissions associated with those industries that are deemed eligible for allowance allocations under ACESA.

Figure IV-3
Emissions of "Presumptively Eligible" Industries and of Remaining Six-Digit Manufacturing Industries with Various Energy and Trade Intensities



KEY:

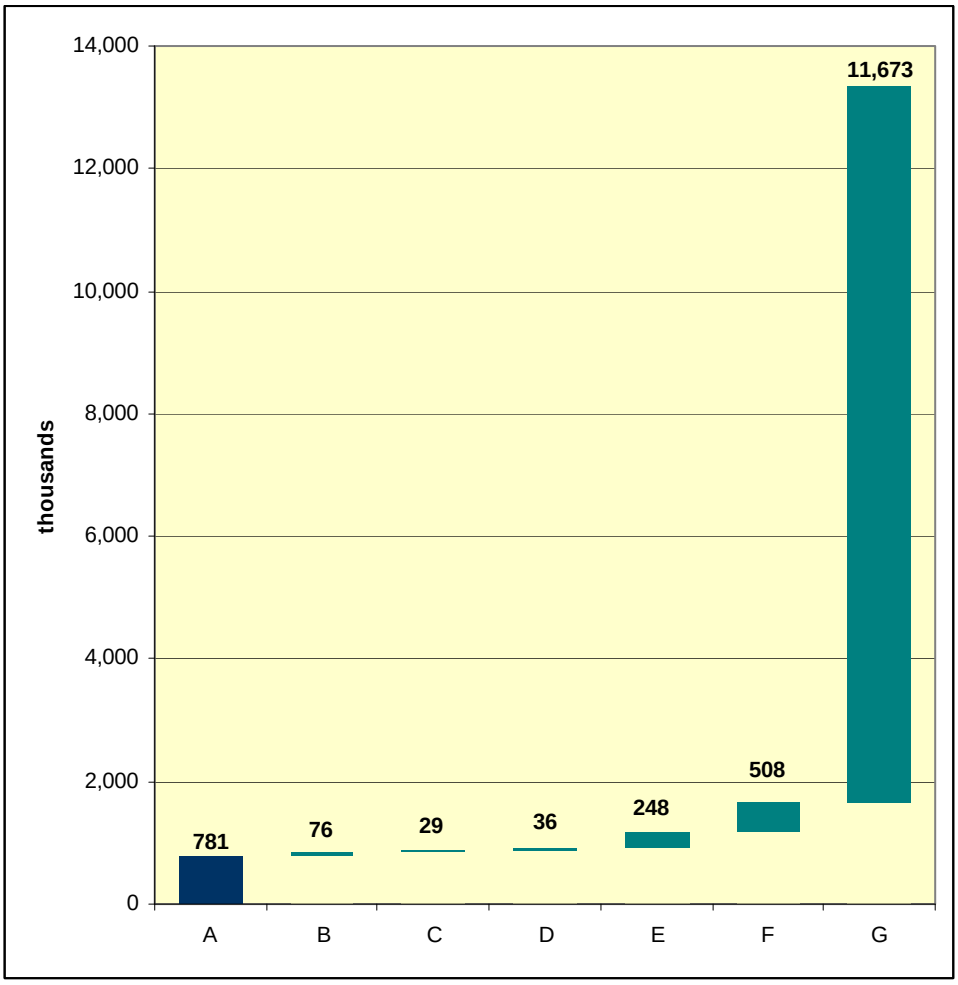
A. Presumptively eligible industries as determined by EPA preliminary assessment
B. Other industries that meet energy intensity threshold with trade intensity between 10% and 15% or missing
C. Other industries that meet energy intensity threshold with trade intensity between 5% and 10%
D. Other industries that meet energy intensity threshold with trade intensity less than 5%
E. Other industries with energy intensity between 3.5% and 5%
F. Other industries with energy intensity between 2.5% and 3.5%
Other industries with energy intensity below 2.5%

Source: EPA analyses, 2009.

[43]Two examples of these industries are Steel Foundries and Broadwoven Fabric Mills.

Figure IV-4 differs from Figure IV-3 by showing the number of employees, rather than emissions, in all manufacturing industries, also aggregated into the "presumptively eligible" industries and into various categories of trade and energy intensity for those industries not deemed presumptively eligible.

Figure IV-4
Employment in "Presumptively Eligible" Industries and in Remaining NAICS Manufacturing Industries by EITE Category - 2007



KEY:

G. Presumptively eligible industries as determined by EPA preliminary assessment
H. Other industries that meet energy intensity threshold with trade intensity between 10% and 15% or missing
I. Other industries that meet energy intensity threshold with trade intensity between 5% and 10%
J. Other industries that meet energy intensity threshold with trade intensity less than 5%
K. Other industries with energy intensity between 3.5% and 5%
L. Other industries with energy intensity between 2.5% and 3.5%
M. Other industries with energy intensity below 2.5%

Source: EPA Interagency Report, *The Effects of H.R. 2454 on International Competitiveness and Emission Leakage in Energy-Intensive Trade-Exposed Industries, December 2, 2009;* Management Information Services, Inc., 2010.

The U.S. manufacturing sector employed over 13 million people in 2007, representing about 10 percent of total nonfarm employment. Figure IV-4 shows that the overwhelming majority -- nearly 95 percent -- of employees in the manufacturing sector fall outside the "presumptively eligible" industries. In fact, 88 percent of manufacturing employees work in industries with energy intensities below 2.5 percent.

IV.B.3. ACESA EITE Provisions

For a production entity to be eligible to receive EITE allowances, it must be in a sector that meets EITE eligibility criteria. ACESA uses the six-digit NAICS classification level to define sectors, and qualifying sectors are those whose output meets either 1) a threshold for average energy or GHG intensity[44] and trade intensity[45] or 2) a very high energy or GHG intensity (Table IV-1). Eligibility criteria are designed to identify industries that – due to their increased reliance on what will be higher-priced energy inputs, exposure to foreign (potentially uncapped) competition, or exceptional GHG emissions necessitating large purchases of emissions allowances -- stand to lose the most should a U.S. policy capping emissions be enacted.[46] As shown in Table IV-1, 46 sectors have been identified as being eligible for EITE permits.[47]

Policies addressing these concerns seek to achieves three key goals:

- Minimize the economic risk to U.S. EITE industries caused by higher costs
- Guard against "emissions leakage" from a loss of market share to more carbon-intensive foreign producers
- Provide for equitable distribution of relief to EITE firms that need it the most

As noted, ACESA includes two provisions aimed at addressing competitiveness concerns: A program for freely allocating a number of emission allowances to qualifying EITE industries, and an import allowance requirement, coming into effect in 2020, if major emitting competitors do not agree to binding commitments of their own. Figure

[44]Energy intensity is the cost of purchased electricity and fuel for the sector divided by the value of shipments of the sector. GHG intensity is a measure of GHGs emitted by the sector divided by the value of shipments of the sector.

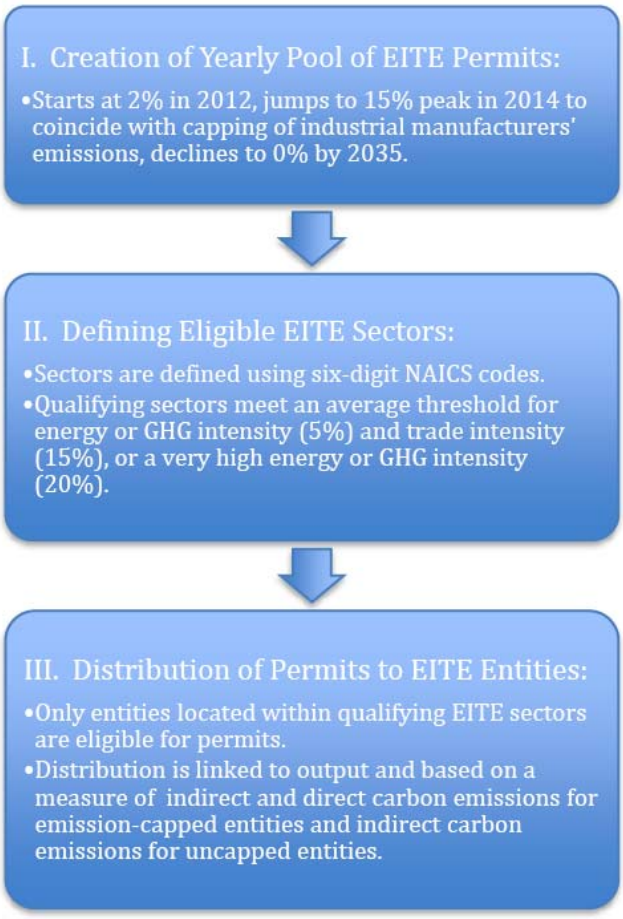
[45]Trade intensity is the value of total imports and exports of the sector divided by the value of the shipments plus the value of imports.

[46]While the EPA Administrator is charged with creating an initial list of eligible sectors and updating that list periodically (once in 2013 and every four years thereafter), owners of entities falling outside the list of eligible sectors may petition EPA to designate their subsector of six-digit NAICS industries eligible for EITE allowances, provided they meet the same eligibility criteria as the larger, six-digit NAICS sectors. Allowances would then be given on a prorated basis to those newly eligible facilities, dating from the year the petition was submitted, and taken from the current year's pool of EITE allowances.

[47]Eligible sectors meet an energy or GHG intensity threshold of five percent (rounded to nearest whole number) and a trade intensity of 15 percent, or a very high energy or GHG intensity of 20 percent.

IV-5 illustrates the system for allocating allowances to EITE industries, dividing program rules into three parts.

Figure IV-5
Process for Identifying Eligible EITE Sectors and Distributing Emission Allowances to Entities Within Qualifying EITE Sectors



Source: Duke University, 2009.

For emissions-capped EITE entities, the number of emission allowances received is based on 1) a facility's output times a measure of direct carbon emissions per unit of output across the sector (the direct carbon factor) and 2) its output times a measure of GHG emissions from the entity's purchased electricity times a measure of average electricity use per unit of output across the sector (the indirect carbon factor). Uncapped entities that fall within qualifying EITE sectors are given allowances based on their indirect carbon factor only. If the entity has received payments from its electricity provider – based on the ACESA energy cost containment provisions -- an adjustment is made to ensure that firms receiving free allowances are not credited for purchases of electricity not borne by them or for which they have been otherwise compensated by their electricity provider. Using an output-based allocation methodology based on the sector average provides an advantage to more efficient entities within the sector, who will receive allowances equivalent to the sector average, but will generally need less

than that due to their lower emissions per unit. The surplus can then be sold, and this is intended to provide an ongoing incentive for efficiency improvements.

Output-based allocation of free permits to certain EITE industries (the method used in ACESA) is considered to be an improvement over allocation that is not tied to output -- the approach taken by the EU, since the former effectively shifts firms' marginal production costs downward and thereby improves terms of trade, while the latter is essentially a fixed subsidy that does little to improve competitiveness.[48]

Nevertheless, output-based allocation has its own difficulties. For example, it can weaken or even eliminate the carbon price signal, which is the objective of an efficient cap-and-trade program to begin with. In addition, awarding free permits to energy-intensive firms creates a perverse incentive at odds with the goal of transitioning to alternative, less energy-intensive production, and fails to distinguish between competition from countries with and without domestic climate policies. However, recent analyses indicate that, while output-based allocations can essentially eliminate the leakage that is associated with the reduced international competitiveness of domestic industry, if carefully designed, these allocations can do so while preserving incentives for industry to reduce the emission-intensity of its production.[49]

Because of the heterogeneity of manufacturing processes and products that can be covered under a single six-digit NAICS code, some analysts have expressed concern that energy, GHG, and trade intensity calculations will be difficult to derive in some cases due to lack of a central physical unit to use in the calculation.[50] Further, any resulting estimate based on sectoral averages may lack efficiency and equity, under-allocating allowances to EITE industries that fall outside of qualifying sectors and over-allocating allowances to non-EITE industries that fall within qualifying sectors.

Three issues may lead to over- and under-allocation of EITE allowances:

- Manufacturing of products within a single six-digit NAICS code can vary widely with respect to energy and greenhouse gas intensity, frustrating attempts to accurately define energy- or GHG-intensive sectors.
- Products within a single six-digit NAICS code may serve different markets and not compete with one another, frustrating attempts to accurately define trade-intensive sectors.
- Facilities manufacturing several products under one roof are assigned a single NAICS code reflecting the largest value operation

[48]See Carolyn Fisher and Alan Fox, "Output-Based Allocations of Emissions Permits: Efficiency and Distributional Effects in a General Equilibrium Setting with Taxes and Trade," Resources for the Future Discussion Paper 04-37, 2004.

[49]"The Effects of H.R. 2454 on International Competitiveness and Emission Leakage in Energy-Intensive Trade-Exposed Industries," an interagency report responding to a request from Senators Bayh, Specter, Stabenow, McCaskill, and Brown, December 2009 (revised February 2010).

[50]For example, NAICS Sector 325188, "All Other Basic Inorganic Chemical Manufacturing," will have a myriad of products not easily aggregated to physical units such as tons.

at the site. If products are manufactured individually at separate sites, a facility's eligibility for EITE allowances may change.

ACESA is ambiguous on how production output will be valued and credited. If production is valued in physical output, EPA will be tasked with determining appropriate output measures for qualifying sectors that may have different products that are not directly comparable and additive. However, if output is measured in the dollar value of shipments rather than in physical units, the program rewards high-value product manufacturers at the expense of the lower-value product manufacturers -- who may actually have greater exposure to EITE risks than the high-value producers.[51]

Another concern relates to the number of EITE firms falling outside of eligible six-digit NAICS sectors and their right to petition EPA to designate a subsector of six-digit NAICS industries eligible for EITE allowances. While ACESA language on petitioning is fairly straightforward -- eligibility is based on meeting the same criteria as the larger six-digit NAICS sectors, and EPA must make a final ruling no later than six months after the petition is submitted, an evaluation of the number of products and entities potentially covered is essential to any estimation of the number of EITE allowances distributed to firms, since the total EITE allowance pool is fixed in size.

Finally, it is useful to put the size of the U.S. EITE industries in perspective. Manufacturing represented about $1.5 trillion of the $12.5 trillion 2005 U.S. GDP. The past decade has seen overall output stagnate, and employment falling by 17 percent, prior to the 2007 - 2009 current recession.[52] About 95 percent of employees in the manufacturing sector fall outside EITE industries, and EITE manufacturing represents about:

- Three percent of U.S. economic output
- Less than two percent of total employment
- Less than six percent of total direct U.S. GHG emissions

IV.C. Estimating the Job Impacts on the EITE Industries

IV.C.1. Methodology for Estimating Employment Effects

The employment effects on the EITE Industries were estimated using the Management Information Services, Inc. model, data base, and information system – see Appendix A. The national model was used, and no regional or occupational estimates were developed.

[51]Plant-level information to address these issues is contained in government databases collected by the Census Bureau, but there are restrictions on access and use of these data at the plant level, even for government analysis, that need to be resolved.

[52]Trevor Houser, Rob Bradley, Britt Childs, Jacob Werksman, and Robert Heilmayr, *Leveling the Carbon Playing Field: International Competition and U.S. Climate Policy Design*, Peter G. Peterson Institute for International Economics, 2008.

The High Technology case:

- Assumes lower costs, higher efficiencies for equipment and building shells, and earlier availability of some advanced equipment than in the Reference case, as consumers place greater importance on the value of future energy savings.
- In the residential market: Earlier availability, lower costs, and higher efficiencies are assumed for more advanced equipment. Building shell efficiencies for new construction meet ENERGY STAR requirements after 2016, and consumers evaluate efficiency investments at a seven percent real discount rate.
- In the commercial market: Earlier availability, lower costs, and higher efficiencies for more advanced equipment. Energy efficiency investments are evaluated using a seven percent real discount rate. Building shell efficiencies for new and existing buildings increase by 17.4 and 7.5 percent respectively, from 2003 to 2035, a 25 percent improvement relative to the Reference case.
- In the industrial market: Earlier availability, lower costs, and higher efficiencies for more advanced equipment are assumed, and higher efficiency for more advanced equipment and a more rapid rate of improvement in the recovery of biomass byproducts from industrial processes (0.7 percent per year, as compared with 0.4 percent per year in the Reference case). Although the choice of the 0.7 percent annual rate of improvement in byproduct recovery is an assumption, it is based on the expectation that there would be higher recovery rates and substantially increased use of CHP. Delivered energy intensity declines by 1.2 percent annually.
- In the transportation market: Advanced technologies are less costly and more efficient than in the Reference case. The characteristics of conventional and alternative-fuel LDVs reflect more optimistic assumptions about incremental improvements in fuel economy and costs. In the freight truck sector, the case assumes more rapid incremental improvement in fuel efficiency for engine and emissions control technologies. More optimistic assumptions for fuel efficiency improvements also are made for the air, rail, and shipping sectors. The economics of fuel-saving technologies improve and consumers buy more efficient vehicles. However, average fuel economy improves modestly, because the CAFE standards assumed already require significant improvement in fuel economy performance and the penetration of advanced technologies.
- In the electricity market: Costs for new advanced fossil-fired generating technologies do not improve due to learning over time from 2010.

As discussed, there is a set of six-digit North American Industry Classification System (NAICS) industries that would likely be deemed "presumptively eligible" for allocations under H.R. 2454. The final determination of "presumptively eligible" industries would be made in a formal EPA rulemaking upon enactment of legislation. In our analysis, the most current indicators were used to determine these industries, based on energy intensity and trade intensity. It was assumed that any allocations of allowances would also be based on some form of industry output, probably the value of shipments.

IV.C.2. Job Impacts on EITE Industries

According to the preliminary assessment of the nearly 500 six-digit manufacturing industries, 46 industries and subsectors would be deemed "presumptively eligible" for allowance rebates under H.R. 2454 (Table IV-1). Of these, 12 are in the chemicals sector, four are in the paper sector, 13 are in the nonmetallic minerals sector (*e.g.,* cement and glass manufacturers), and eight are in the primary metals sector (*e.g.*, aluminum and steel manufacturers). Many of these sectors are at or near the beginning of the value chain, and provide the basic materials needed for manufacturing advanced technologies. In total, in 2007, the "presumptively eligible" industries accounted for 12 percent of total manufacturing output and employed about 780,000 workers, or about six percent of manufacturing employment and one-half percent of total U.S. non-farm employment.

Table IV-2 lists the top 20 industries out of the 46 that are currently the most energy intensive.

Table IV-2
Most Energy-Intensive Industries

NAICS code	Title	Energy Intensity
325181	Alkalies and Chlorine Manufacturing (incl soda ash beneficiation)	24%
327410	Lime Manufacturing	23%
331312	Primary Aluminum Production	22%
331311	Alumina Refining	21%
322122	Newsprint Mills	16%
327211	Flat Glass Manufacturing	16%
327310	Cement Manufacturing	15%
325311	Nitrogenous Fertilizer Manufacturing	14%
327213	Glass Container Manufacturing	14%
322130	Paperboard Mills	12%
212210	Iron Ore Mining	11%
331112	Electrometallurgical Ferroalloy Product Manufacturing	11%
327212	Other Pressed and Blown Glass and Glassware Manufacturing	11%
327123	Other Structural Clay Product Manufacturing	10%
311221	Wet Corn Milling	10%
327992	Ground or Treated Mineral and Earth Manufacturing	9%
311213	Malt manufacturing	9%
325188	All Other Basic Inorganic Chemical Manufacturing	8%
311613	Rendering and Meat Byproduct Processing	8%
322121	Paper (except Newsprint) Mills	8%

Source: EPA Interagency Report, *The Effects of H.R. 2454 on International Competitiveness and Emission Leakage in Energy-Intensive Trade-Exposed Industries, December 2, 2009;* and Management Information Services, Inc., 2010.

Table IV-3 lists the top 20 industries out of the 46 that are currently the most trade intensive.

Table IV-3
Most Trade-Intensive Industries

NAICS code	Title	Trade Intensity
331419	Primary Smelting and Refining of Nonferrous Metal (ex Copper & Aluminum)	135%
325192	Cyclic Crude and Intermediate Manufacturing	102%
327112	Vitreous China, Fine Earthenware, and Pottery Product Manufacturing	94%
322110	Pulp Mills	90%
325221	Cellulosic Organic Fiber Manufacturing	90%
325311	Nitrogenous Fertilizer Manufacturing	83%
331112	Electrometallurgical Ferroalloy Product Manufacturing	77%
331311	Alumina Refining	70%
327122	Ceramic Wall and Floor Tile Manufacturing	69%
322122	Newsprint Mills	68%
331312	Primary Aluminum Production	64%
327111	Vitreous China Plumbing Fixture and Bathroom Accessories	60%
327212	Other Pressed and Blown Glass and Glassware Manufacturing	58%
325188	All Other Basic Inorganic Chemical Manufacturing	58%
325212	Synthetic Rubber Manufacturing	57%
331411	Primary Smelting and Refining of Copper9	55%
335991	Carbon and Graphite Product Manufacturing	52%
327211	Flat Glass Manufacturing	51%
325199	All Other Basic Organic Chemical Manufacturing	49%
327125	Nonclay Refractory Manufacturing	46%

Source: EPA Interagency Report, *The Effects of H.R. 2454 on International Competitiveness and Emission Leakage in Energy-Intensive Trade-Exposed Industries, December 2, 2009;* and Management Information Services, Inc., 2010.

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Table IV-4 lists the top 20 industries out of the 46 that are currently have the highest GHG intensities.

Table IV-4
Industries with Highest GHG Intensities

NAICS code	Title	GHG Intensity at $20/TCO2
327410	Lime Manufacturing	33.0%
325311	Nitrogenous Fertilizer Manufacturing	18.5%
327310	Cement Manufacturing	15.9%
331311	Alumina Refining	9.0%
331312	Primary Aluminum Production	9.0%
212210	Iron Ore Mining	7.3%
331112	Electrometallurgical Ferroalloy Product Manufacturing	6.1%
325182	Carbon Black Manufacturing	5.4%
322122	Newsprint Mills	5.1%
325181	Alkalies and Chlorine Manufacturing (incl soda ash beneficiation)	5.0%
327212	Other Pressed and Blown Glass and Glassware Manufacturing	3.7%
327123	Other Structural Clay Product Manufacturing	3.5%
311221	Wet Corn Milling	3.3%
327992	Ground or Treated Mineral and Earth Manufacturing	3.0%
325188	All Other Basic Inorganic Chemical Manufacturing	2.9%
322130	Paperboard Mills	2.9%
331111	Iron and Steel Mills	2.6%
311213	Malt manufacturing	2.6%
327211	Flat Glass Manufacturing	2.5%
327122	Ceramic Wall and Floor Tile Manufacturing	2.4%

Source: EPA Interagency Report, *The Effects of H.R. 2454 on International Competitiveness and Emission Leakage in Energy-Intensive Trade-Exposed Industries, December 2, 2009;* and Management Information Services, Inc., 2010.

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Tables IV-5 and IV-6 list the I-O sectors we used in analyzing the impact of the Basic Case on industry employment.

Table IV-5
ACESA 2020 Employment Impact on Energy-Intensive Trade-Exposed Industries

2020 EITE Industry (number of detailed industries)	Number (thous.)	Change (percent)
Textile mills and product mills (2)	-2	-0.4
Primary metals (8)	-2	-0.3
GDP	**-**	**-0.3**
Mining (2)	-1	-0.3
Chemical products (12)	-3	-0.2
Wood products (1)	-1	-0.1
Paper products (4)	-1	-0.1
Nonmetallic mineral products (13)	-1	-0.1
Food and beverage (3)	-1	0
Electrical equipment, appliances, and components (1)	0	0
Total of EITE sectors	-12	

Source: Management Information Services, Inc., 2010.

Table IV-6
ACESA 2030 Employment Impact on Energy-Intensive Trade-Exposed Industries

2030 EITE Industry (number of detailed industries)	Number (thous.)	Change (percent)
Textile mills and product mills (2)	-12	-2.9
Mining (2)	-11	-2.4
Primary metals (8)	-18	-2.1
Chemical products (12)	-25	-1.1
Electrical equipment, appliances, and components (1)	-7	-0.8
GDP	**-**	**-0.8**
Wood products (1)	-6	-0.8
Nonmetallic mineral products (13)	-6	-0.7
Paper products (4)	-5	-0.7
Food and beverage (3)	-8	-0.3
Total of EITE sectors	-98	

Source: Management Information Services, Inc., 2010.

In the 2020 forecasts for the Reference Case and the Basic Case, GDP is projected to decline 0.3 percent, and only two EITE industries (10 detailed industries) show a decline greater than the decrease in GDP. In the 2030 forecasts for the Reference Case and the Basic Case, GDP is projected to decline 0.8 percent, and five EITE industries (25 detailed industries) show a decline greater than the decrease in GDP.

We found that the primary influence of the overall economic decline in GDP in the ACESA cases overwhelmed the specific industry impacts that might be caused directly by the ACESA, after the allowances and other benefits of the legislation are realized by the industries.

Table IV-7 lists the I-O sectors and the detailed NAICS EITE industries. In almost all cases, the 2020 and 2030 employment impacts to the I-O sector are small in comparison to the 2007 employment levels. In 2020, the EITE-affected sectors will account for a loss of 12,000 and in 2030 they will account for a loss of 98,000 jobs across the economy. The grey boxes in Table IV-7 denote the EITE industries where there may be as many as 1,000 jobs lost due to the ACESA.

Table IV-7
Detailed Employment Impact on Energy-Intensive Trade-Exposed Industries

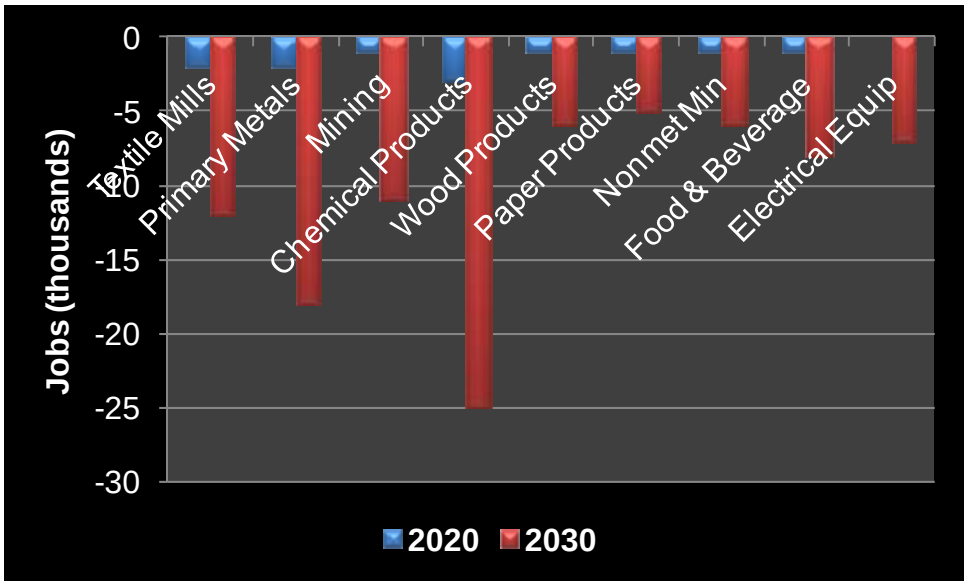
NAICS Code	I-O Sector and NAICS Title	2007 I-O Sector and NAICS Employment	2007 NAICS Employment in Sector	2020 Employment Impact (thousands)	2030 Employment Impact (thousands)
	Mining	238,000		-1	-11
212210	Iron Ore Mining	4,989	2%		
212234	Copper Ore and Nickel Ore Mining	10,384	4%		
	Food and beverage	1,843,000		-1	-8
311213	Malt manufacturing	1,022	0%		
311221	Wet Corn Milling	8,448	0%		
311613	Rendering and Meat Byproduct Processing	9,355	1%		
	Textile mills and product mills	366,000		-2	-12
313111	Yarn Spinning Mills	24,750	7%		
314992	Tire Cord and Tire Fabric Mills	3,577	1%		
	Wood products	511,000		-1	-6
321219	Reconstituted Wood Product Manufacturing	20,426	4%		
	Paper products	420,000		-1	-5
322110	Pulp Mills	7,268	2%		
322121	Paper (except Newsprint) Mills	75,921	18%		
322122	Newsprint Mills	4,917	1%		
322130	Paperboard Mills	36,641	9%		
	Chemical products	1,229,000		-3	-25
325110	Petrochemical Manufacturing	9,257	1%		
325131	Inorganic Dye and Pigment Manufacturing	7,606	1%		
325181	Alkalies and Chlorine Manufacturing (incl soda ash benif.)	6,364	1%		
325182	Carbon Black Manufacturing	1,591	0%		
325188	All Other Basic Inorganic Chemical Manufacturing	35,801	3%		
325192	Cyclic Crude and Intermediate Manufacturing	3,006	0%		
325199	All Other Basic Organic Chemical Manufacturing	70,602	6%		
325211	Plastics Material and Resin Manufacturing	71,216	6%		
325212	Synthetic Rubber Manufacturing	9,794	1%		
325221	Cellulosic Organic Fiber Manufacturing	1,353	0%		
325222	Noncellulosic Organic Fiber Manufacturing	14,684	1%		
325311	Nitrogenous Fertilizer Manufacturing	3,920	0%		
	Nonmetallic mineral products	544,000		-1	-6
327111	Vitreous China and Earthenware Plumbing Fixtures	4,825	1%		
327112	Vitreous China, Earthenware Other Pottery Manufacturing	8,774	2%		
327113	Porcelain Electrical Supply Manufacturing	4,465	1%		
327122	Ceramic Wall and Floor Tile Manufacturing	6,272	1%		
327123	Other Structural Clay Product Manufacturing	1,650	0%		
327125	Nonclay Refractory Manufacturing	5,338	1%		
327211	Flat Glass Manufacturing	10,991	2%		
327212	Other Pressed and Blown Glass Manufacturing	21,189	4%		
327213	Glass Container Manufacturing	14,928	3%		
327310	Cement Manufacturing	17,749	3%		
327410	Lime Manufacturing	4,369	1%		
327992	Ground or Treated Mineral and Earth Manufacturing	6,497	1%		
327993	Mineral Wool Manufacturing	18,891	3%		
	Primary metals	536,000		-2	-18
331111	Iron and Steel Mills	114,315	21%		
331112	Electrometallurgical Ferroalloy Product Manufacturing	2,144	0%		
331210	Iron & Steel Pipe & Tube Manufacturing from Purch. Steel	17,408	3%		
331311	Alumina Refining	1,611	0%		

331312	Primary Aluminum Production	9,355	2%		
331411	Primary Smelting and Refining of Copper	1,771	0%		
331419	Primary Smelting & Refining of Nonferrous Metal (ex. Cu & Al)	8,067	2%		
331511	Iron Foundries	51,503	10%		
	Electrical equipment, appliances, and components	484,000		0	-7
335991	Carbon and Graphite Product Manufacturing	8,666	2%		
	Total	**783,670**		**-12**	**-98**

Source: EPA Interagency Report, *The Effects of H.R. 2454 on International Competitiveness and Emission Leakage in Energy-Intensive Trade-Exposed Industries, December 2, 2009;* and Management Information Services, Inc., 2010.

Figure IV-6 summarizes the impacts on employment in select industries in 2020 and 2030. This figure illustrates that while generally small, the job losses are larger in 2030 than in 2020.

Figure IV-6
Summary of EITE Job Impacts



Source: Management Information Services, Inc., 2010.

V. FINDINGS

The major findings of this research are, with respect to the jobs impact of ACESA:

- Some studies (CRA, ACCF, NAM, Heritage, etc.) contend that ACESA and climate change initiatives would cause massive job destruction – losses of 2 – 3 million jobs per year
- However, the results derived here do not support this
- We found that, under reasonable assumptions, the net job impact of ACESA is likely to be very small and may total less than 0.03 percent of the labor force
- This is true of both the ACESA Basic Case (Scenario 2) and the more aggressive HT Case (Scenario 3) which assumes a 20 percent RPS
- Our results indicating relatively small job impacts are supported by the findings of numerous studies conducted by EIA, CBO, EPA, and other organizations
- Nevertheless, some industries – and the occupations concentrated in them – will be significantly affected, both positively and negatively
- Thus, minimal total net job changes can obscure large job losses and gains in some industries

With respect to the job impact of ACESA on the EITE industries, we found that:

- Employment in the EITE industries is a small portion of both total employment and manufacturing employment, and 95 percent of manufacturing sector jobs fall outside EITE industries
- The overall effect of ACESA on EITE industries is likely to be minimal
- However, there may be several exceptions to this
- Nevertheless, in general, exogenous factors over next two decades will exceed the jobs impacts of ACESA on EITE industries

APPENDIX A: THE MISI MODEL

The economic and employment effects of the ACESA initiatives were estimated using the Management Information Services, Inc. model, data base, and information system. A simplified version of the MISI model as applied in this study is shown in Figure A-1.

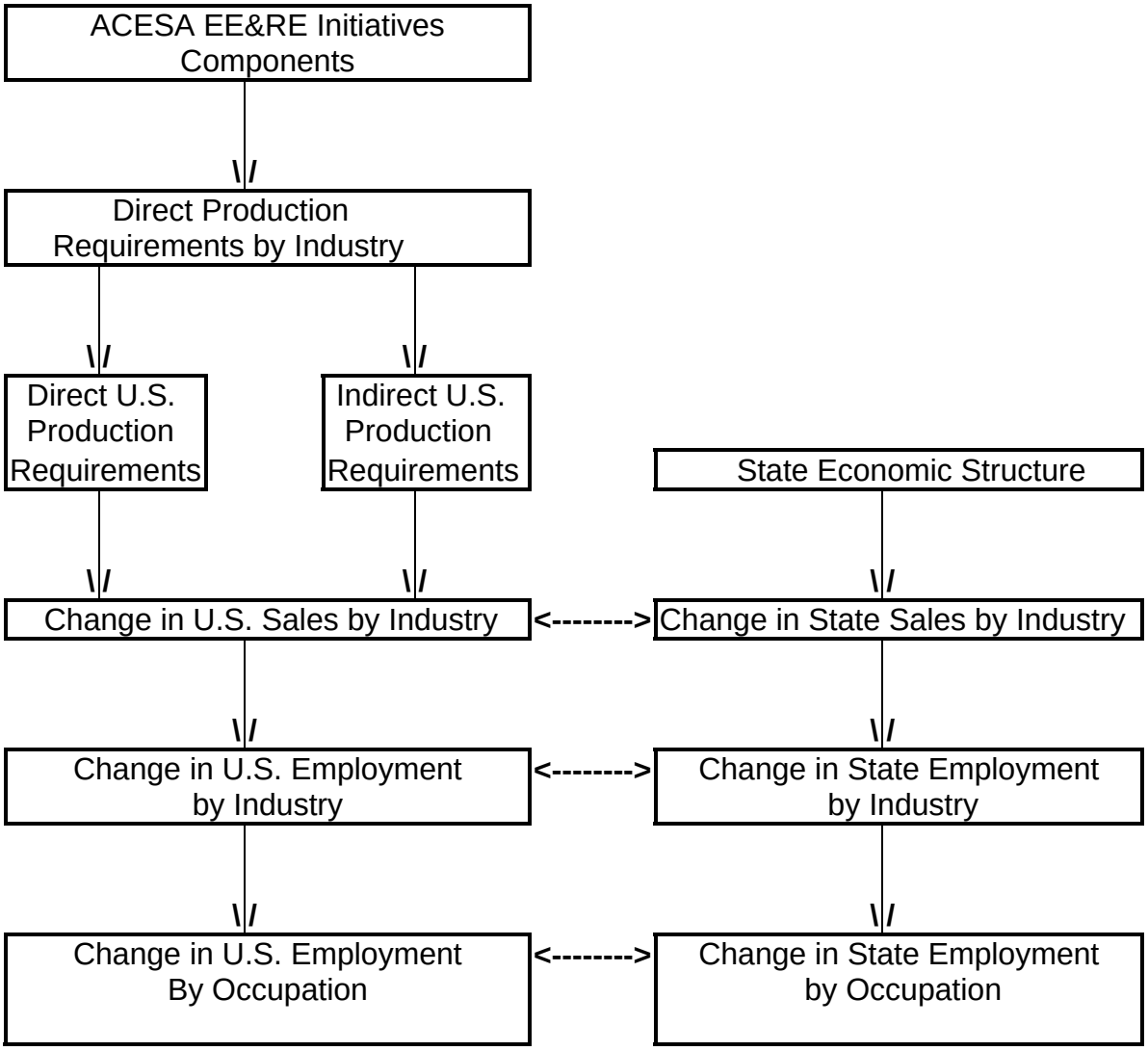
The first step in the MISI model involves the estimation of the direct requirements of the ACESA initiatives from every supporting industry in the economy. For example, construction of a photovoltaics power system will require a wide range of hardware and services from many industries, whereas production of electric and hybrid vehicles will generate requirements for hardware and services from a very different configuration of industries. Production of a photovoltaics power system will generate large direct requirements in the electrical equipment and components, computer and electronic products, nonmetallic minerals, and related industries, whereas production of electric and hybrid vehicles will generate large direct requirements in the motor vehicle and parts, plastics and rubber products, primary metals, fabricated metal products, and related industries.

The MISI model translates the expenditures for the specified ACESA initiatives component into per unit output requirements from every supporting industry in the economy. In general, this is determined by four major factors: 1) the specific ACESA EE&RE initiatives component, 2) the distribution of expenditures among industries, 3) the specific expenditure/technology configuration, and 4) the direct industry requirements structure. While the MISI model contains 490 commodities and industries, in the work conducted here a 70-order industry scheme will be used -- the 70-order industries are listed in Table IV-1.

Second, the direct output requirements of every supporting industry affected as a result of the ACESA EE&RE initiatives are estimated, and they reflect the production and technology requirements implied by the initiative. These direct requirements show, proportionately, how much an industry must purchase from every other industry to produce one unit of output.

Direct requirements, however, give rise to subsequent rounds of indirect requirements. For example, electric and hybrid vehicles will require steel, and steel mills require electricity to produce steel. But an electric utility requires turbines from a factory to produce electricity. The factory requires steel from steel mills to produce turbines, and the steel mill requires more electricity, and so on.

Figure A-1
Use of the MISI Model to Estimate the Economic, Employment, and Occupational Impacts of the ACESA Initiatives



Source: Management Information Services, Inc., 2009.

Table A-1
U.S. Input-Output Industry Codes and Titles, 70-Order

National Industry Codes and Titles by NAICS

Industry Code	Industry Title	NAICS Code
111CA	Farms	111,112
113FF	Forestry, fishing, and related activities	113-115
211	Oil and gas extraction	211
212	Mining, except oil and gas	212
213	Support activities for mining	213
22	Utilities	22
23	Construction	23
311FT	Food and beverage and tobacco products	311, 312
313TT	Textile mills and textile product mills	313, 314
315AL	Apparel and leather and allied products	315, 316
321	Wood products	321
322	Paper products	322
323	Printing and related support activities	323
324	Petroleum and coal products	324
325	Chemical products	325
326	Plastics and rubber products	326
327	Nonmetallic mineral products	327
331	Primary metals	331
332	Fabricated metal products	332
333	Machinery	333
334	Computer and electronic products	334
335	Electrical equipment, appliances, and components	335
3361MV	Motor vehicles, bodies and trailers, and parts	3361-3363
3364OT	Other transportation equipment	3364-3369
337	Furniture and related products	337
339	Miscellaneous manufacturing	339
42	Wholesale trade	42
44RT	Retail trade	44, 45
481	Air transportation	481
482	Rail transportation	482
483	Water transportation	483
484	Truck transportation	484
485	Transit and ground passenger transportation	485
486	Pipeline transportation	486
487OS	Other transportation and support activities	487-492
493	Warehousing and storage	493

Table A-1 (continued)
U.S. Input-Output Industry Codes and Titles, 70-Order

Industry Code	Industry Title	NAICS Code
511	Publishing industries (includes software)	511
512	Motion picture and sound recording industries	512
513	Broadcasting and telecommunications	513
514	Information and data processing services	514
521CI	Federal Reserve banks, credit intermediation, and related activities	521, 522
523	Securities, commodity contracts, and investments	523
524	Insurance carriers and related activities	524
525	Funds, trusts, and other financial vehicles	525
531	Real estate	531
532RL	Rental and leasing services and lessors of intangible assets	532, 533
5411	Legal services	5411
5412OP	Miscellaneous professional, scientific and technical services	5412-5414, 5416-5419
5415	Computer systems design and related services	5415
55	Management of companies and enterprises	55
561	Administrative and support services	561
562	Waste management and remediation services	562
61	Educational services	61
621	Ambulatory health care services	621
622HO	Hospitals and nursing and residential care facilities	622, 623
624	Social assistance	624
711AS	Performing arts, spectator sports, museums, and related activities	711, 712
713	Amusements, gambling, and recreation industries	713
721	Accommodation	721
722	Food services and drinking plACESA	722
81	Other services, except government	81
GFE	Federal government enterprises	n/a
GFG	Federal general government	n/a
GSLE	State and local government enterprises	n/a
GSLG	State and local general government	n/a
S004	Inventory valuation adjustment	n/a

Notes: n/a - Not applicable

Source: Management Information Services, Inc. and U.S. Department of Commerce, Bureau of Economic Analysis, 2009.

The latter are the indirect requirements. The sum of the direct plus the indirect requirements represents the total output requirements from an industry necessary to produce one unit of output for the ACESA EE&RE initiatives. Economic input-output (I-O) techniques allow the computation of the direct as well as the indirect production requirements, and these total requirements are represented by the "inverse" equations in the model. The ratio of the total requirements to the direct requirements is called the input-output multiplier.

Thus, in the third step in the modeling sequence the direct industry output requirements are converted into total output requirements from every industry by means of the input-output inverse equations. These equations show not only the direct requirements, but also the second, third, fourth, nth round indirect industry and service sector requirements resulting from the EE&RE expenditures.

Next, the total output requirements from each industry are used to compute sales volumes, value added (including profits and taxes) for each industry. Then, using data on manhours, labor requirements, and productivity, employment requirements within each industry are estimated. This allows computation of the total number of jobs created within each industry.

The next step requires the conversion of total employment requirements by industry into job requirements for specific occupations and skills. To accomplish this, MISI utilizes data on the occupational composition of the labor force within each industry and estimates job requirements for 800 occupations within 22 occupational groups encompassing the entire U.S. labor force. This permits estimation of the impact of TCC expenditures on jobs for specific occupations and on skills, education, and training requirements.

Utilizing the modeling approach outlined above, the MISI model allows estimation of the effects on employment, personal income, corporate sales and profits, and government tax revenues in the U.S. and in each state. Estimates can then be developed for detailed industries and occupations.

The final step in the analysis (which was not carried out in this study) entails assessing the economic impact on specific cities -- Metropolitan Statistical Areas (MSAs). The MISI approach permits disaggregation to the level of most U.S. MSAs and, if desired, to the county level. Empirically, the basis of the sub-state estimates is the MISI version of the Regional Input-Output Modeling System (RIMS II) developed by the U.S. Commerce Department's Bureau of Economic Analysis (BEA).

The MISI model and data base permit economic impacts to be estimated for any region composed of one or more counties and for any industry in the national I-O table. MISI can estimate the impacts of project and program expenditures by industry on regional output (gross receipts or sales), earnings (the sum of wages and salaries, proprietors' income, and other labor income, less employer contributions to private pension and welfare funds), and employment.

For the MSAs there may be further interest in estimating the impact on requirements for specific occupations. This can be accomplished using the MISI occupation-by-industry matrix, the coefficients of which show the percent distribution of occupational employment among all industries. The 500-by-800 matrix was developed from the *Current Population Survey*, and was modified to conform to the available data.

The methodology employed is state-of-the-art and credible, and has been used by MISI over past three decades in many studies of energy and environmental projects, economic initiatives, proposed legislation, government programs, etc.

Databases and Data Sources

MISI maintains extensive proprietary and nonproprietary databases on the U.S. economy, the state economies, on the Metropolitan Statistical Areas within the states, and on counties in the states. The major public sources of the nonproprietary data include:

- The Bureau of Economic Analysis of the U.S. Commerce Department
- The Bureau of the Census of the U.S. Commerce Department
- The Bureau of Labor Statistics of the U.S. Labor Department
- The Energy Information Administration of the U.S. Energy Department

In addition:

- MISI has proprietary economic forecasting databases for the U.S. and for most states, developed and utilized over the past three decades.
- MISI staff has developed extensive technology-, program-, environmental-, and state-specific economic and statistical databases and satellite models.

Thus, the direct and indirect effects of the RE industry on the national and state economies can be disaggregated into the impact on:

- Industry sales (490 4-digit NAICS industries)
- Jobs (800 occupations and skills)
- Corporate profits
- Federal, state, and local government tax revenues
- Employment and unemployment (by industry and occupation)
- Net growth or displacement of new businesses
- Major economic, technological, social, and environmental parameters and externalities

MISI derives these estimates using quantitative models and databases it has on-line and which have been used by MISI in many other analogous disaggregate regional, economic, technological, and environmental studies. These models and data are unique and proprietary and give MISI substantial estimation capabilities in this area. These models include:

- The U.S. Commerce Department's national input-output model
- A modified version of the Commerce Department's regional econometric forecasting model.
- A modified version of the Regional Input-Output Modeling System (RIMS) supplemented with the Census Bureau/BLS industry-occupation matrix -- adapted to state and sub-state economies by MISI.
- A modified version of the Energy Externalities Simulation (EES) model developed by MISI.

Use of these proprietary models and the associated databases permitted MISI to develop estimates of the economic and employment impacts of each of the mitigation options.

MANAGEMENT INFORMATION SERVICES, INC.

Management Information Services, Inc. is an economic research and management consulting firm with expertise on a wide range of complex issues, including energy, electricity, and the environment. The MISI staff offers expertise in economics, information technology, engineering, and finance, and includes former senior officials from private industry, federal and state government, and academia. Over the past three decades MISI has conducted extensive proprietary research, and since 1985 has assisted hundreds of clients, including Fortune 500 companies, nonprofit organizations and foundations, academic and research institutions, and state and federal government agencies including the White House, the National Academy of Sciences, the U.S. Department of Energy, the U.S. Environmental Protection Agency, the Energy Information Administration, the Department of Defense, NASA, and the U.S. General Services Administration.

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