



*Final Report to Texas Comptroller of Public Accounts*

## **The Proposed American Clean Energy and Security Act of 2009 and Related Energy/Environment Federal Legislation**

### **Considerations for the Texas Economy**

August 31, 2009<sup>1</sup>

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<sup>1</sup> This report was prepared by Dr. Michelle Michot Foss, Chief Energy Economist and Head and Dr. Gürcan Gülen, Senior Energy Economist, Center for Energy Economics, BEG-UT.

## **Acknowledgements**

The University of Texas, Bureau of Economic Geology's (BEG's) Center for Energy Economics (CEE) is privileged to collaborate with the Texas Comptroller of Public Accounts (CPA) to evaluate implications for Texas of key Federal initiatives that affect the State's energy sector and overall economy. The analysis by CEE researchers and CPA staff was conducted using the Policy Insight+ modeling system developed and licensed to CPA by Regional Economic Modeling Inc. (REMI-PI). CEE researchers have no rights to, or ability to affect changes to, the REMI-PI modeling system. All information used by CEE researchers derive from public domain sources. Any specific information provided for this research effort is for the use of this effort only. Details regarding assumptions, approach and preliminary results are provided in this report as well as recommendations for future analysis and strategies for Texas.

# **The Proposed American Clean Energy and Security Act of 2009 and Related Energy/Environment Federal Legislation: Considerations for the Texas Economy**

## **Background and Executive Summary**

The University of Texas, Bureau of Economic Geology's (BEG's) Center for Energy Economics (CEE)<sup>2</sup> was asked to advise and assist the Texas Comptroller of Public Accounts (CPA) in its evaluation of potential State impacts associated with key Federal legislative and regulatory initiatives. Of most importance for CPA is the proposed American Clean Energy and Security Act of 2009 (ACESA, HR 2454) and related policy and regulatory actions to address greenhouse gas (GHG) mitigation in the US.

At roughly 1,400 pages, ACESA is broad in scope, encompassing actions that would permeate throughout the US economy and society. However, ACESA and GHG emissions are not the only items on the Federal plate. Among other initiatives that will affect Texas are oil and gas tax proposals and general energy provisions embedded in the Obama Administration budget blueprint (and in the previously enacted American Recovery and Reinvestment Tax Act of 2009, ARRA).

Congressional and Federal agency proposals target issues like financial and commodity market reform and oversight (how financial derivatives trading is conducted and overseen has substantial implications for both existing commodity markets as well as emerging markets like carbon); and specific activities such as hydraulic fracturing ("fracing") that are vital to oil and gas industry operations. Actions at the US Department of Interior (US DOI) related to oil and gas and other mineral leasing may affect activity and costs in the US. As well, the Texas legislative session considered a number of energy related proposals. Several were passed, related to carbon capture and sequestration (CCS); alternative vehicle technologies; tax incentives for "clean coal," "clean energy," and renewable energy projects; and implementation of transmission projects for competitive renewable energy zones (CREZ), among others.

Of concern to CPA going forward are revenues and associated employment, income, investment and gross state product measures as these developments unfold. ACESA and other policy/regulatory actions overlay a national and global economic recession that is historic in scale and scope and declines in commodity prices that have already affected the State's economy (albeit to a smaller degree than other states and regions in the US).

CEE researchers are collaborating with CPA staff to track ACESA as it progresses through Congress (as of this writing, ACESA has been passed by the full House and

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<sup>2</sup> For information on CEE's research, outreach and training programs and activities, see [www.beg.utexas.edu/energyecon](http://www.beg.utexas.edu/energyecon).

action has been taken up by the Senate). CEE helped to devise scenarios for CPA to test using the integrated national-regional modeling tool, Policy Insight or PI+, which CPA obtains from Regional Economic Modeling Inc. (hereafter REMI-PI) and uses for a variety of State revenue and economic planning and analysis requirements. Further work will be done by the CEE and CPA team (CPA/CEE) to refine model output as the US Senate deliberates and should the bill become law. CEE also is assisting CPA in tracking other Federal energy and energy-related environment and economic developments to assess potential State impacts.

To help devise recommended scenarios for CPA modeling, CEE researchers are relying on their ongoing research as well as information networks related to energy and climate economics. CEE has a number of projects and grants underway or under development that overlap with CPA's request for assistance. CEE and CPA are actively sharing resources and contacts and coordinating to review modeling inputs and outputs. As of this writing, alternative scenarios for the ACESA GHG cap and trade provisions have been compiled for the national and regional (Texas) geographies and compared to the REMI-PI baseline. CEE also is benchmarking REMI-PI model outputs against peer studies and other targeted studies.

Input for CPA/CEE scenarios was drawn from studies by Charles River Associates for the National Black Chamber of Commerce (NBCC/CRA, released in August 2009) and the US Energy Information Administration's (USEIA) analysis of ACESA also released in August. Both reports yielded specific inputs related to carbon prices that incorporate critical assumptions about energy technology and demand side adjustments. For peer review of results, CPA/CEE relied upon The Heritage Foundation; American Center for Capital Formation and National Association of Manufacturers joint study for which Science Applications International Corporation conducted modeling (ACCF/NAM/SAIC); the US Environmental Protection Agency (USEPA); and, for targeted aspects, Stanford Energy Modeling Forum and CEE-UT's own research, among others.

Two key results have been obtained.

1. **A national scenario of potential impacts associated with ACESA 2009 has been produced that is broadly consistent with scenarios released by other groups and organizations that are being used as benchmarks.** Using the NBCC/CRA ACESA reference carbon price case, CPA/CEE results with REMI-PI show total employment nationwide declines 1.4 percent by 2030 (about 2.8 million jobs lost) from the baseline case (without ACESA). Baseline case total employment is about 203 million. Gross domestic product (GDP) declines by about 2 percent (\$402 billion, in 2000 dollars) and real disposable income by about 1.2 percent (\$441 billion, in 2000 dollars).
2. **A regional (Texas) scenario that advances previous work by CPA (March 2009).** Using the NBCC/CRA ACESA reference carbon price case, by 2030 total employment declines by just over 1.1 percent (about 173,000 jobs lost). Baseline case (without ACESA) total employment for Texas is about 15 million. Gross state product (GSP) declines by almost 1.7 percent (almost \$26 billion, in 2000 dollars) and real disposable income by roughly 0.9 percent (roughly \$24 billion, in 2000 dollars). Given the dominant presence of low labor-, high capital-intensive industries (petrochemical and non-energy manufacturing),

potential impacts on Texas gross state product and real disposable personal income may outweigh employment effects.

It is important to emphasize the following.

- The declines in employment, income and economic output are differences between a reasonable base case projection of the future and cases with ACESA included. All peer reviewed studies follow the same convention.
- These model results do not incorporate any assumptions of specific benefits for Texas associated with ACESA. For instance, CEE and CPA did not attempt to capture job creation and economic output associated with growth in industries, such as those associated with renewable energy technologies. We also did not attempt to isolate losses and costs associated with specific industries that might be more heavily impacted by ACESA.
- The carbon cost adjustments do reflect added expense to industrial, commercial and household customers as these kinds of shifts begin to occur with ACESA. With implementation of ACESA, a series of responses begin to filter throughout the US and Texas economies. Most directly, the imposition of emissions constraints and the prospect of ever increasing caps in the future – even with free allowances, offsets and other mitigation options – do affect the cost of energy supplies. In addition, our carbon price adjustments reflect the cost of mandates designed to push renewable energy sources further into the US energy mix (embedded in the NBCC/CRA and USEIA assumptions and results).
- ***Indeed, a key question for any economic analysis of ACESA or similar proposals is whether the economic costs associated with fundamental changes in the US energy supply portfolio can be balanced with sufficient economic growth from new businesses and jobs of comparable or greater wage and salary profiles to at least neutralize detrimental impacts.***
- ***Moreover, if ACESA or similar legislation becomes law, a critical issue will be whether other nations adopt similar GHG mitigation strategies so that, along with mitigating allowances provided in ACESA, US export industries continue to be competitive and thrive.***
- Finally, we have not attempted to estimate additional costs associated with the myriad mandates and requirements incorporated in ACESA. In its June 5, 2009, scoring of ACESA, the Congressional Budget Office (CBO) stated that: “CBO estimates that the cost of mandates in the bill would well exceed the annual thresholds established in UMRA [Unfunded Mandates Reform Act] for intergovernmental and private-sector mandates (in 2009, \$69 million and \$139 million respectively, adjusted annually for inflation)”.<sup>3</sup>

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<sup>3</sup> See <http://cbo.gov/ftpdocs/102xx/doc10262/hr2454.pdf>.

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# **The Proposed American Clean Energy and Security Act of 2009 and Related Energy/Environment Federal Legislation: Considerations for the Texas Economy**

## **ACESA 2009: Key Points for Current Analysis**

The University of Texas, Bureau of Economic Geology's (BEG) Center for Energy Economics (CEE) was asked to advise and assist the Texas Comptroller of Public Accounts (CPA) in its evaluation of potential State impacts associated with key Federal legislative and regulatory initiatives. Of most importance for CPA is the proposed American Clean Energy and Security Act of 2009 (ACESA, HR 2454) and related policy and regulatory actions to address greenhouse gas (GHG) mitigation in the United States.

ACESA, passed by the US House of Representatives in a close 219-212 vote on June 26, 2009, weighs in at roughly 1,400 pages (about 500 pages larger than the draft bill as voted out of the House Energy and Commerce Committee on May 21, 2009). ACESA is broad in scope, encompassing actions that would permeate throughout the US economy and society. However, ACESA is not the only item on the Federal plate. Among other initiatives that will affect Texas are oil and gas tax proposals and general energy provisions embedded in the Obama Administration budget blueprint (and in the previously enacted American Recovery and Reinvestment Tax Act of 2009, ARRA). Congressional and Federal agency proposals target issues like financial and commodity market reform and oversight (how financial derivatives trading is conducted and overseen has substantial implications for both existing commodity markets as well as emerging markets like carbon); and specific activities such as hydraulic fracturing ("fracing") that are vital to oil and gas industry operations. Actions at the US Department of Interior (US DOI) related to oil and gas and other mineral leasing may affect activity and costs in the US. As well, the Texas legislative session considered a number of energy related proposals. Several were passed, related to carbon capture and sequestration (CCS); alternative vehicle technologies; tax incentives for "clean coal," "clean energy," and renewable energy projects; and implementation of transmission projects for competitive renewable energy zones (CREZ), among others.

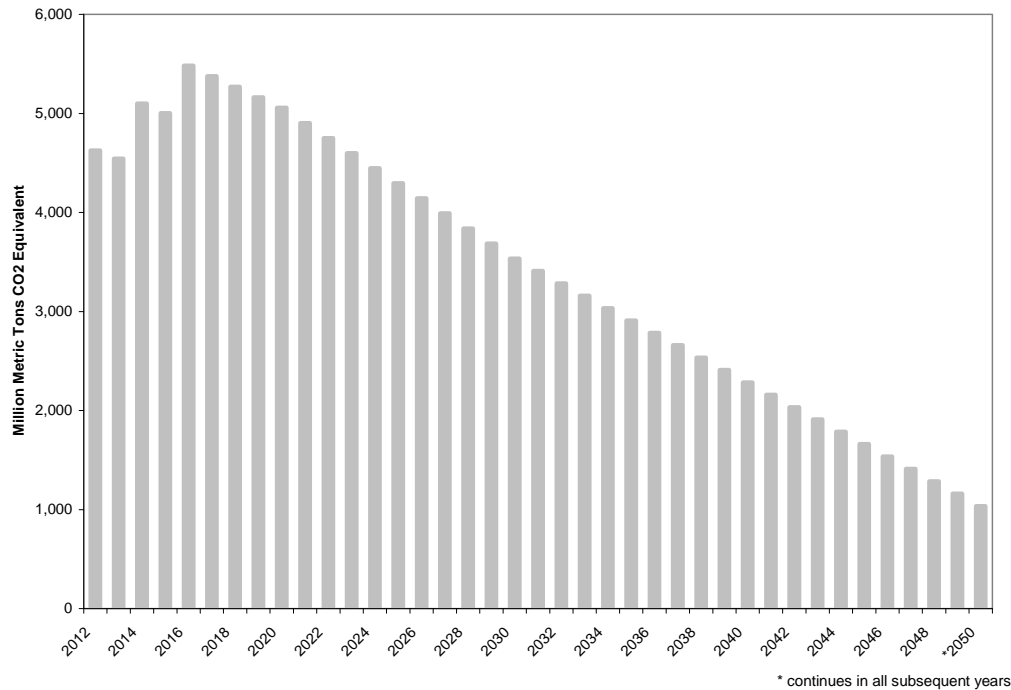
ACESA 2009 includes both direct energy titles for spurring development of clean energy (such as renewable energy standards and incentives for carbon capture and sequestration or CCS) and promoting energy efficiency as well as the major global warming title. The latter entails creation of emissions allowances (which can be bought, sold and traded with no restrictions), disposition of allowances, consumer and sensitive industry protections and adaptation provisions.<sup>4</sup>

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<sup>4</sup> All documents related to ACESA 2009 can be accessed at [http://energycommerce.house.gov/index.php?option=com\\_content&view=article&id=1633&catid=155&Itemid=55](http://energycommerce.house.gov/index.php?option=com_content&view=article&id=1633&catid=155&Itemid=55).

The chart below illustrates the annual caps on carbon dioxide (CO2) equivalent emissions that are central to ACESA.

**Figure 1. Annual CO2 Equivalent Emissions Caps, ACESA 2009**



Source: Developed by CEE based on information in ACESA.

CO2 equivalent tonnages are specified in ACESA as follows. The importance of equivalence is that ACESA will affect not only fossil fuel industries, but a variety of activities, including those by individuals, which produce emissions considered to be GHGs. These emissions range from those associated with fossil fuel use (such as fugitive methane emissions from natural gas facilities) to coolants and other chemicals that filter through daily life. ACESA also provides for additional GHGs to be included at the discretion of the US Environmental Protection Agency (USEPA).

**Table 1. Conversions for CO2 Equivalence**

Greenhouse Gas (1 metric ton carbon dioxide equivalent)	
Carbon dioxide	1
Methane	25
Nitrous oxide	298
HFC-23 (hydrofluorocarbons, HFCx)	14,800
HFC-125	3,500
HFC-134a	1,430

<b>Greenhouse Gas (1 metric ton carbon dioxide equivalent)</b>	
HFC-143a	4,470
HFC-152a	124
HFC-227ea	3,220
HFC-236fa	9,810
HFC-4310mee	1,640
CF4 (perfluorocarbons, CF <sub>x</sub> )	7,390
C2F6	12,200
C4F10	8,860
C6F14	9,300
SF6 (sulfur hexafluoride)	22,800
NF3 (nitrogen trifluoride)	17,200

The Obama Administration budget blueprint rests on the premise that 100 percent of all allowances would be auctioned. Importantly, ACESA, as voted out of the Committee and House, provides that only 15 percent of all allowances would be auctioned (with funds to be used for low income consumers). The 15 percent of allowances to be auctioned for household income support do not phase out. The emission allowance scheme in the final House version of ACESA is considerably more complex than the House Energy and Commerce Committee draft, with significant implications not only for economic impact analysis but also for cost of implementation and enforcement should ACESA become law.

ACESA as it stands contains little in the way of programmatic detail in spite of the vast reach of programs, requirements and responsibilities, complicating the development of economic impact scenarios.<sup>5</sup> However, a number of aspects of the proposed bill bear consequences for the nation and State of Texas.

- Central to the bill and of highest priority for CPA analysis are the creation and disposition of carbon allowances in the global warming title. While the majority of allowances are allocated freely until 2030, the balance (15 percent) must be purchased representing a cost that will affect both businesses and consumers. This portion of ACESA provides the most clarity for analysis.
- The global warming title also contains numerous regulatory, reporting and administrative requirements that will have broad impact across public and

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<sup>5</sup> For a section by section summary of ACESA prepared by staff at the Texas State Comptroller see <http://cpa.state.tx.us/finances/captrade/>.

private activities. Examples are creation of a GHG registry and GHG reporting for ACESA compliance. It is not possible to estimate the costs for businesses and individuals to comply with these rules.

- The climate change adaptation and clean energy transition titles contain a large assortment of new programs and institutions as well as expanded requirements for existing programs and institutions that reach across both public and private activities. It is not possible to estimate the cost or economic impacts of these sections.
- All provisions related to research and development or incentives for specific energy supply technologies and energy use must be funded. If funds are appropriated, at least some of this Federal budget allocation would likely flow to programs and activities in Texas. Certain benefits could be created that should be considered. These include, for instance, subsidies (beyond carbon allowances) to stimulate investment in CCS by electric utilities, a major strategic interest in Texas.
- Federal funds must be appropriated and budget neutrality for ACESA is in no way assured. As passed by the House, ACESA gives away 85 percent of GHG allowances during the first years with most allowances distributed freely for an extended period of time. As noted, the original White House budget blueprint called for 100 percent of allowances to be auctioned.<sup>6</sup> Given the large differences between ACESA provisions and the original Administration budget blueprint, Federal revenue shortfalls are likely to be substantial if ACESA becomes law in its current form. Indeed, the White House recently confirmed a long expected revision to more negative deficit projections, a consequence of overly optimistic economic assumptions, costs of proposed new programs and declining revenue estimates.<sup>7</sup> Already, a variety of research and analysis efforts are in place to assess the broader economic and financial implications of the Federal budget deficit outlook. Downward price movements for US Treasuries as well as interest rate spreads are indicative of negative opinions in financial markets and beyond regarding US budget imbalances and projected deficits. Because the sale of carbon allowances constituted a considerable portion of prospective Federal revenues to offset new spending, ACESA has a particular role in Obama Administration aspirations. Potential impacts associated with persistent and very large Federal deficits range from higher costs of borrowing by businesses and consumers to Federal budget cuts and spending constraints that would eliminate and/or reduce some (or all) of the prospective benefits that might be associated with ACESA and other large legislative proposals.

While the purpose of our analysis is not to critique ACESA, it must be said that a variety of caveats, exceptions and opportunities exist to diminish impact of the proposed legislation on emissions reductions. Many opinions are that the

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<sup>6</sup> See <http://www.whitehouse.gov/omb/budget/fy2010/assets/receipts.pdf>. For other White House budget documents, go to <http://www.whitehouse.gov/omb/budget/>.

<sup>7</sup> For instance, see Washington Post coverage, <http://www.washingtonpost.com/wp-dyn/content/story/2009/08/25/ST2009082501309.html>.

banking/borrowing, strategic reserve, offsets and other sections of ACESA would result in a law that does not create binding emissions caps.<sup>8</sup> These same components of ACESA also make it unlikely that carbon prices would reach very high levels, at least for the foreseeable future (and based on prospective 2012 implementation), discouraging emissions reductions. The political negotiation required to produce ACESA – including the broad assortment of free allowances and considerable geographic disparities (states with large coal and coal-fired electric power generation and states with small manufacturing segments are disproportionately advantaged) – also makes it difficult to speculate on whether portions of the bill would be toughened at a later date if ACESA is enacted. As noted above, ACESA is, to a large extent, a spending bill. It is also substantial with respect to bureaucratic operations and costs and will thus impose additional costs on private businesses and individuals for compliance. The House Committee draft of ACESA exempted GHG from other major USEPA programs (criteria and hazardous pollutants, new source review) and thus essentially overruled the Supreme Court endangerment finding and USEPA’s mandatory endangerment proceedings. ACESA as passed by the House excludes these exemptions. Moreover, ACESA assigns a broad array of new responsibilities and programs to a variety of regulatory bodies, essentially creating an extensive shadow regulatory scheme that parallels the “cap and trade” regime.

### **Recommended Scenarios for Analysis**

CEE helped to devise scenarios for CPA to test using the integrated national-regional modeling tool, Policy Insight or PI+, which CPA obtains from Regional Economic Modeling Inc.<sup>9</sup> (hereafter REMI-PI) and uses for a variety of State revenue and economic planning and analysis requirements. Further work will be done by the CEE and CPA team (CPA/CEE) to refine model output as the US Senate deliberates and should the bill become law.

CEE and CPA reviewed and evaluated a number of studies that address economic and, to some extent, environmental effects associated with ACESA. Table 2 summarizes all of the organizations and studies with web links and information on cases used and main features for each study. For ease of explanation in the remainder of this report, we use the term “baseline” to refer to all cases in all studies that do not include ACESA. More discussion on the various studies follows in the later section on Benchmark Studies for Comparison.

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<sup>8</sup> CEE researchers reached this conclusion following an extensive review of ACESA, conversations with a variety of private and public sector sources and review of preliminary analyses and reports as well as research conducted on previous GHG mitigation legislation.

<sup>9</sup> See <http://www.remi.com/index.php> for information about REMI and the PI+ modeling system.

**Table 2. ACESA Economic Impact Studies Reviewed by CEE and CPA**

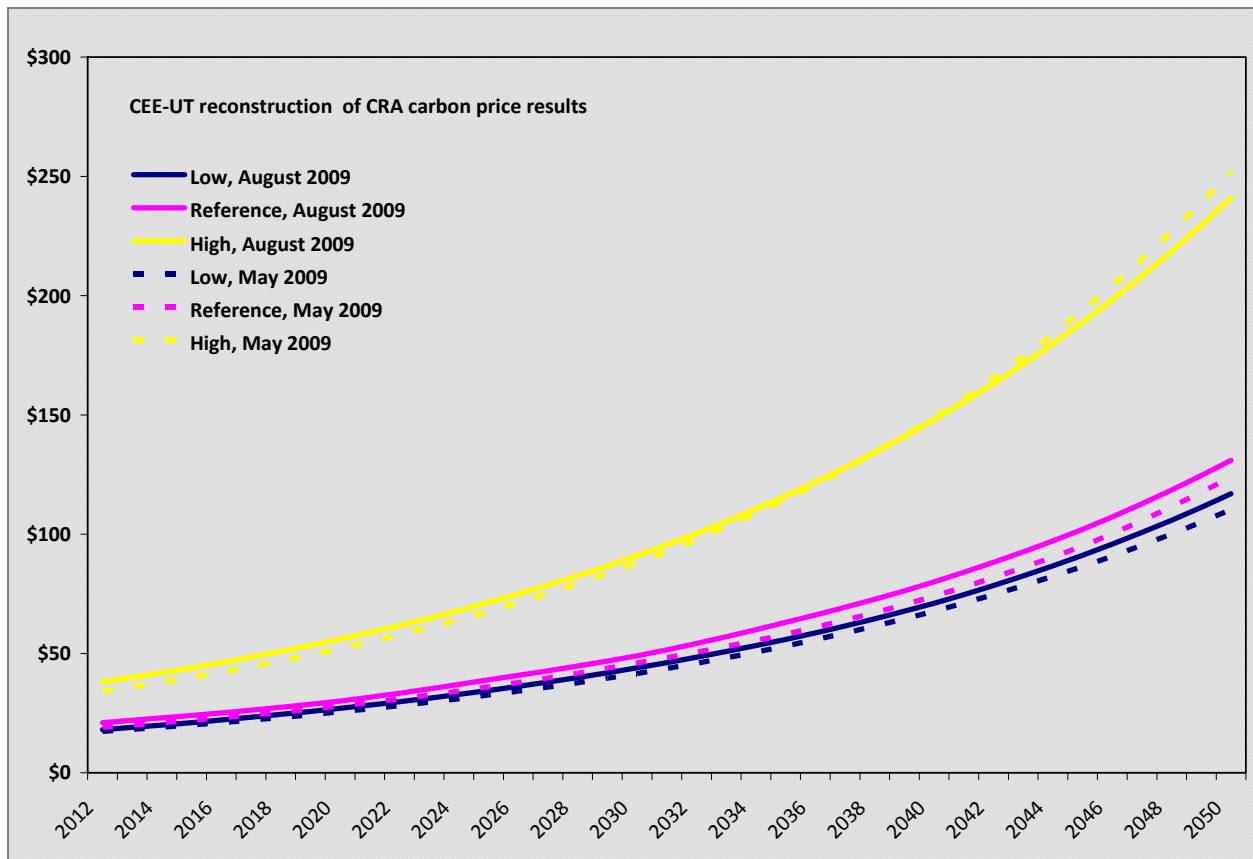
Source (Release Date), Report Link and Supplemental Information	Terminology of Cases	Used in CPA REMI-PI Modeling	Used for Peer Review and Benchmarking
<p>National Black Chamber of Commerce and Charles River Associates, <b>NBCC/CRA</b> (August 2009)  <a href="http://www.nationalbcc.org/index.php?option=com_content&amp;view=article&amp;id=750:nbcc-study-generates-concerns-about-waxmanmarkey-climate-change-bill-costs-are-high-but-benefits-are-uncertain&amp;catid=1:latest-news&amp;Itemid=7">http://www.nationalbcc.org/index.php?option=com_content&amp;view=article&amp;id=750:nbcc-study-generates-concerns-about-waxmanmarkey-climate-change-bill-costs-are-high-but-benefits-are-uncertain&amp;catid=1:latest-news&amp;Itemid=7</a></p> <p>USEIA Annual Energy Outlook (AEO) 2009 Early Release (December 2008) and AEO April Release (with ARRA) and CRA's Multi-Sector, Multi-Region Trade (MS-MRT) model, the Multi-Region National (MRN) model, and the North American Electricity and Environment Model (NEEM)</p>	<p>Baseline = without ACESA                      Reference = with ACESA provisions as specified                      Low Case = lower carbon price as specified                      High Case = higher carbon price as specified</p>	<p>√                      Reference</p>	<p>√                      Reference</p>
<p>US Energy Information Administration, <b>USEIA</b> (August 2009)  <a href="http://www.eia.doe.gov/oiaf/servicerpt/hr2454/index.html?featureclicked=5&amp;">http://www.eia.doe.gov/oiaf/servicerpt/hr2454/index.html?featureclicked=5&amp;</a></p> <p>USEIA AEO 2009 April Release with USEIA's National Energy Modeling System (NEMS)</p>	<p>Reference = without ACESA provisions                      Basic Case = with ACESA provisions as specified</p> <p>Five additional main cases: zero bank case; high offsets case; high cost case; no international (offsets) case; no international limited (technology) case.</p> <p>Additional cases: accelerated corporate average fuel efficiency (CAFE); low discount rate; limited alternatives; accelerated technology; higher level of allowance banking.</p>	<p>√                      Basic Case</p>	<p>√                      Basic Case</p>

Source (Release Date), Report Link and Supplemental Information	Terminology of Cases	Used in CPA REMI-PI Modeling	Used for Peer Review and Benchmarking
<p>The <b>Heritage</b> Foundation (August 6, 2009)  <a href="http://www.heritage.org/Research/EnergyandEnvironment/cda0904.cfm">http://www.heritage.org/Research/EnergyandEnvironment/cda0904.cfm</a></p> <p>IHS Global Insight US Macroeconomic Outlook November 2008 with Heritage’s Center for Data Analysis (CDA) calculations</p>	<p>Baseline = without ACESA  Forecast = with ACESA provisions as specified</p>		<p>√  Forecast</p>
<p>American Center for Capital Formation, National Association of Manufacturers, Science Applications International Corp., <b>ACCF/NAM/SAIC</b> (August 2009)  <a href="http://accf.org/publications/126/accf-nam-study">http://accf.org/publications/126/accf-nam-study</a></p> <p>USEIA AEO 2009 April Release with NEMS as adapted by SAIC</p>	<p>Reference = without ACESA  Low Case = with ACESA provisions, low carbon price as specified  High Case = with ACESA provisions, high carbon price as specified</p>		<p>√  Low Case and High Case</p>
<p>US Environmental Protection Agency, <b>USEPA</b> (June 2009)  <a href="http://www.epa.gov/climatechange/economics/economicanalyses.html#hr2452">http://www.epa.gov/climatechange/economics/economicanalyses.html#hr2452</a></p> <p>USEIA AEO 2009 March Release with EPA’s Applied Dynamic Analysis of the Global Economy (ADAGE) and other models for specific environmental effects</p>	<p>Reference = without ACESA  Scenario 2 = with ACESA provisions as specified  Five additional scenarios: without energy efficiency provisions; without output based rebates; with reference level nuclear; with no international offsets</p>		<p>√  Scenario 2</p>

An initial effort by CPA/CEE utilized the NBCC/CRA early release of ACESA as passed by the House Committee on Energy and Commerce and released in May 2009. A new projection was developed using the NBCC/CRA August 2009 update that reflected ACESA as passed by the House. The NBCC/CRA report includes projections of carbon prices necessary to reach the targeted emissions reductions framed in ACESA. The NBCC/CRA report incorporates reasonable assumptions regarding energy supply and demand responses and provides reference, low and high cases. These include reduced energy purchases by businesses and consumers and substitution; shifts in types of energy fuels consumed; introduction of new energy technologies and associated cost impacts; and changes in industry mix as well as influence of offsets and free allowances distributed according to ACESA provisions. The NBCC/CRA model estimates CO2 prices (and economic outputs) for every five years starting in 2015; CEE extrapolated to have a complete annual series from 2012 to 2030.

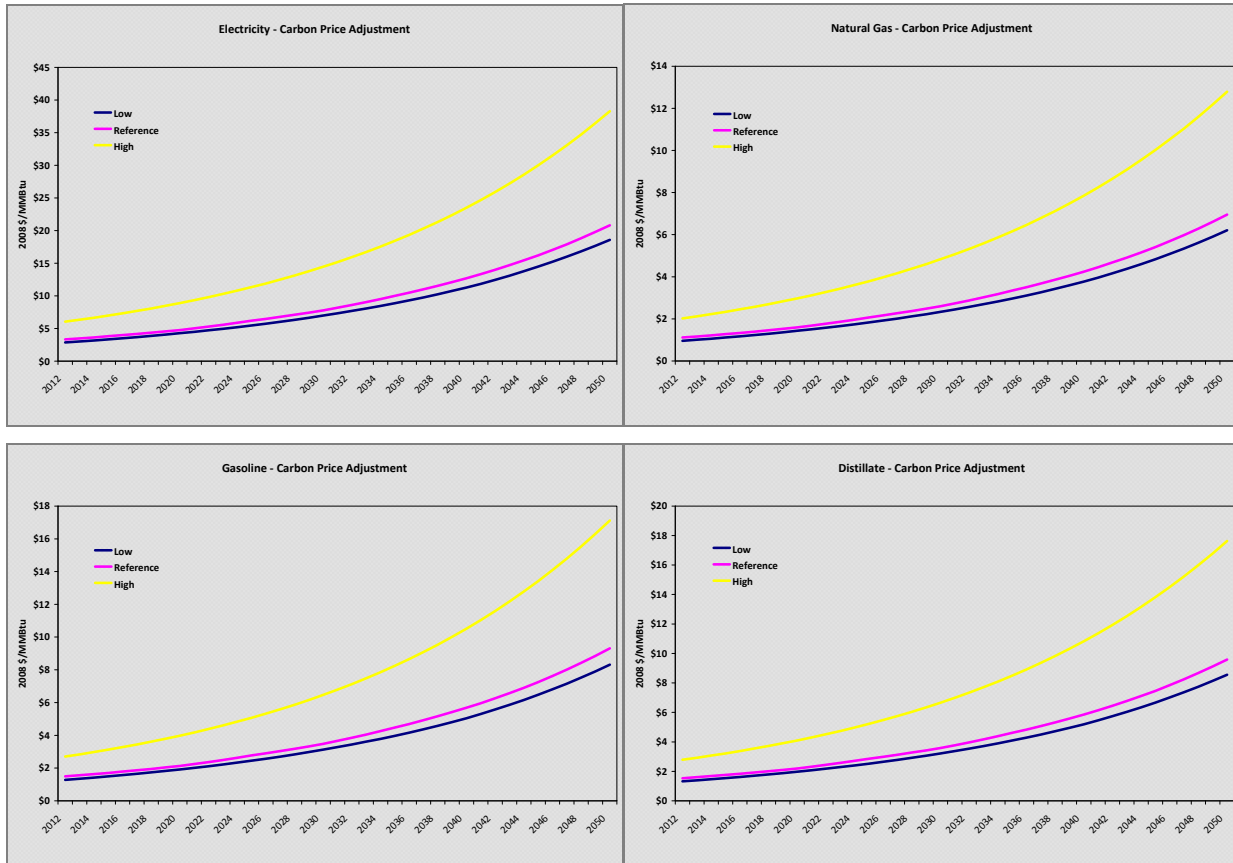
Our reconstruction of the NBCC/CRA carbon price results is shown below, including both the original (May 2009) carbon price results and those from the revised (August 2009) update for comparison. Subsequent charts use only the August 2009 NBCC/CRA update and CPA/CEE projections based on those results. See Table 2 for case terminology.

**Figure 2. NBCC/CRA Reference, Low and High Carbon Price Assumptions for CPA Modeling (\$2008 per metric ton of CO2 equivalent)**



In order to introduce the NBCC/CRA carbon price projections into the CPA REMI-PI model, CEE calculated fuel equivalent carbon price adjustments using USEIA standard emissions factors for each fuel type. All fuel price adjustments are in 2008 dollars per million Btu (\$2008/MMBtu). The charts below show the distribution of carbon price adjustments over time and for the three NBCC/CRA carbon price scenarios (low, reference, high). For illustration, the average price for US natural gas at Henry Hub (in Louisiana, the main pricing point for natural gas) is about \$4.00/MMBtu (as of this writing). If the carbon price factor adjustment for 2015 were applied to today's prices, an expected natural gas price would be \$5.27/MMBtu or roughly a \$1 increase. The reference case natural gas carbon price adjustment in 2030 is about \$2.60; this would increase by roughly two-thirds today's natural gas price and does not consider possible natural gas price increases into the future. The high case natural gas price adjustment in 2030 is \$4.83, which would more than double today's price.

**Figure 3. Carbon Price Adjustments for Key Fuel Types (2008, \$/MMBtu)**



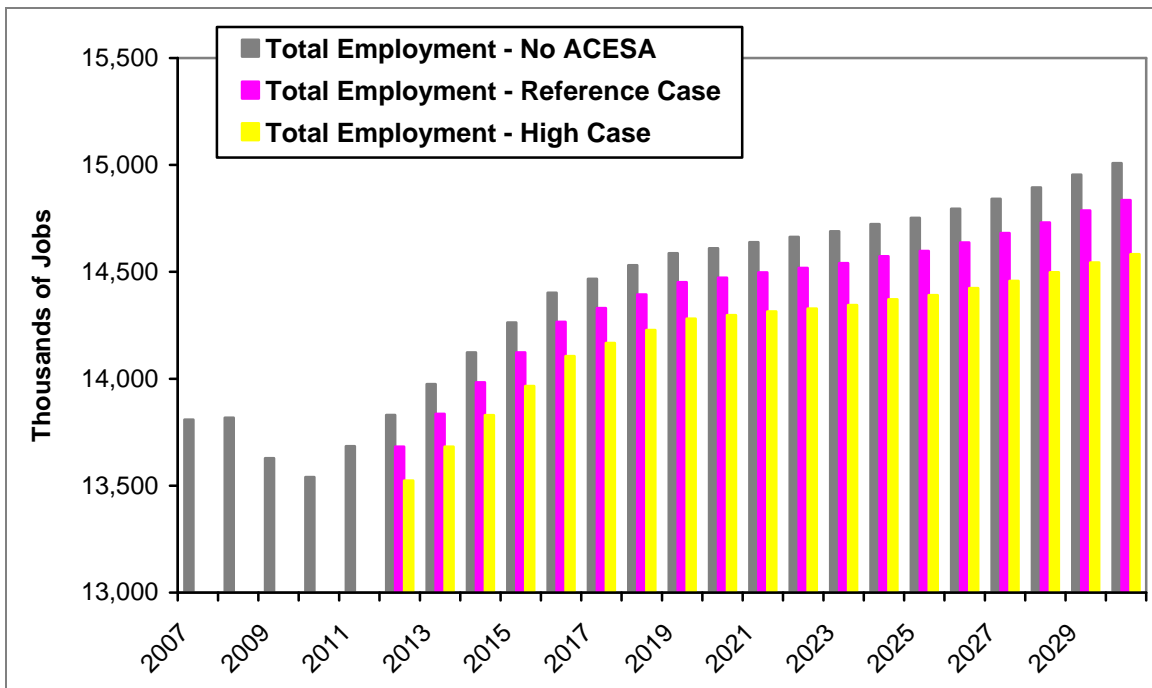
These fuel price adjustments were applied to projected future consumption of each fuel type using IHS Global Insight's US Energy Price Outlook, with energy price projections as of March 2009 and US energy consumption projections as of May

2009<sup>10</sup>, which approximates historical consumption levels in the REMI-PI model. Total projected fuel cost increases for the key REMI-PI commercial and industrial sectors and fuel types were derived. For national level analysis, it is not possible to enter increased expenditures for the household sector by fuel type. Instead, a weighted average of percent increases for each fuel type was calculated and introduced as an increase in consumer prices based on the share of energy in inflation indexes such as the consumer price index (CPI). In a future regional (Texas) simulation, we should be able to introduce consumer expenditures by fuel type. Using the NBCC/CRA reference and high case carbon prices and these fuel cost adjustment approaches in REMI-PI, CPA produced national and regional assessments of potential impacts associated with ACESA for the US and Texas.

## Analysis Results

The charts below illustrate the annual losses in employment, economic output and income. Like NBCC/CRA and other assessments of ACESA, we are concerned with differences between a reasonable base case projection of the future and a cases with ACESA included. In Figure 4 and Figure 5 we show projected impacts on total employment levels in Texas and the United States (without ACESA, with ACESA reference case carbon prices and with ACESA high case carbon prices).

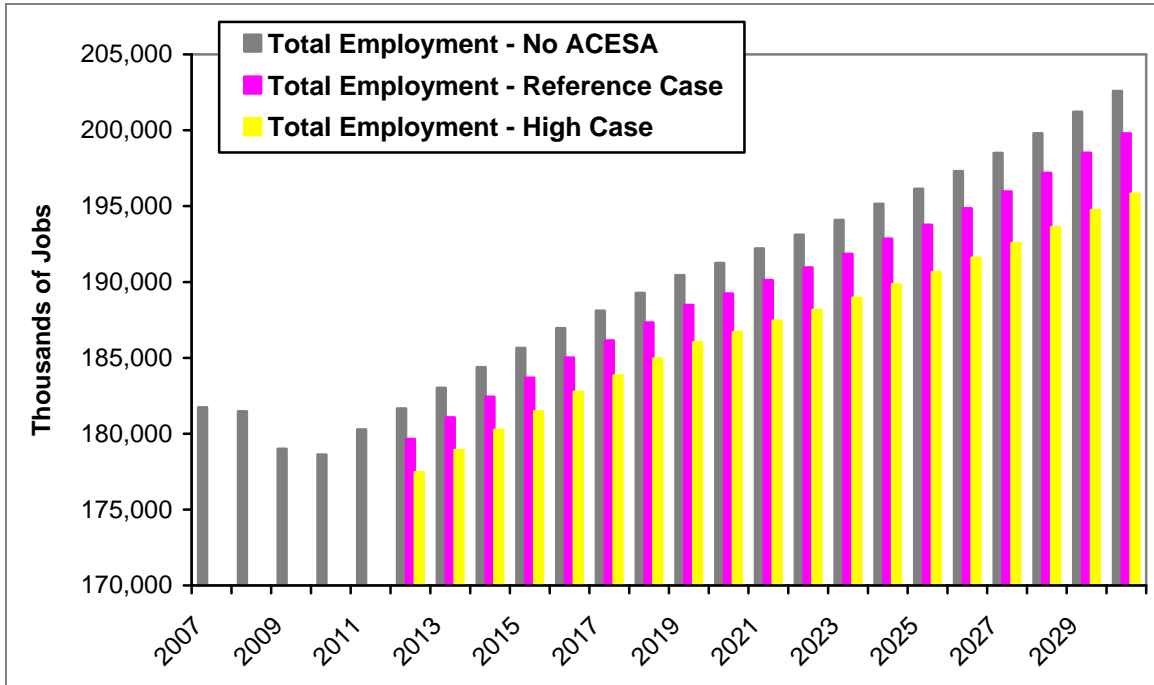
**Figure 4. Projected Impacts on Total Employment Levels for Texas, All Cases**



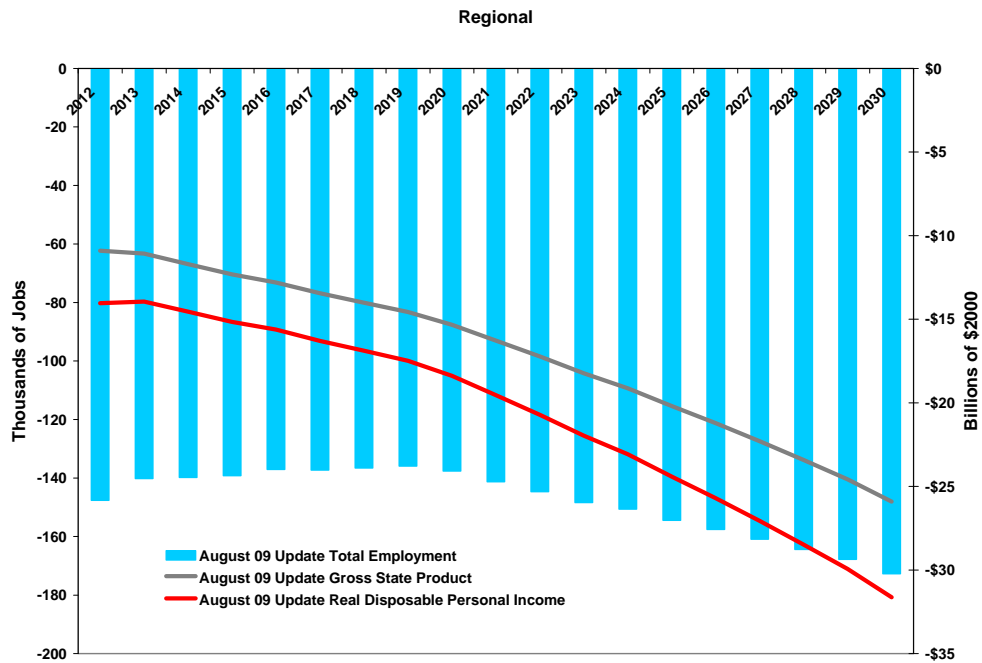
Source: CEE using output from REMI-PI

<sup>10</sup> CEE is a member of the State Data Consortium and uses Global Insight commercial data and forecast products under that umbrella contract. See <http://www.globalinsight.com/>.

**Figure 5. Projected Impacts on Total Employment Levels for the US, All Cases**



Source: CEE using output from REMI-PI



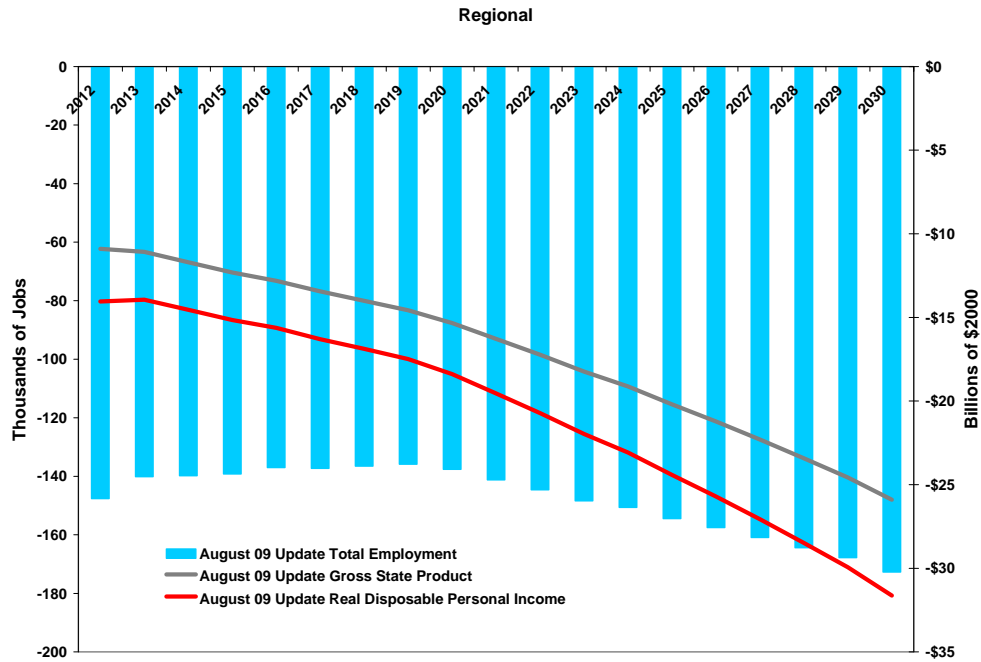
In Figure 6 and

Source: CEE using output from REMI-PI

Figure 7 we highlight the differences between the baseline (no ACESA) projections and reference case total employment, real disposable personal income and real economic output (gross state product and gross domestic product) for Texas and

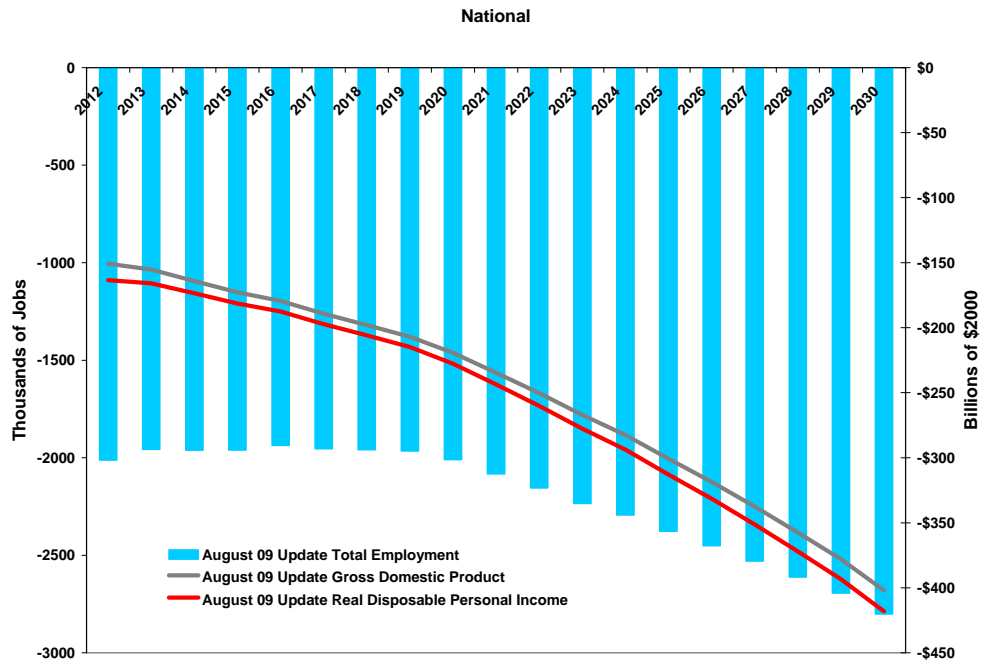
the US, respectively. Using the fuel price adjustments as illustrated above our results suggest that, for the ACESA reference case carbon prices, total employment in Texas could average almost 140,000 fewer jobs between 2012 and 2020, or about 1% lower, with implementation of ACESA. During this time frame, gross state product (GSP) losses average roughly \$13 billion per year, and real disposable personal income drops on average more than \$9 billion per year. From 2021 to 2030, annual average employment losses increase further to about 156,000 jobs as free allowance allocations phase out and industries and consumers face more rapidly increasing fuel costs. Gross state product losses average almost \$21 billion a year and real disposable personal income losses average about \$18 billion a year. Overall, the projected job losses occur relative to a baseline labor market that ranges from about 14 million to 15 million jobs over the forecast horizon (2012 to 2030). Texas baseline GSP ranges from about \$1 trillion to more than \$1.5 trillion and real disposable personal income from about \$800 billion to almost \$1.3 trillion over the forecast horizon (all dollar amounts are fixed 2000 values).

**Figure 6. Projected Impacts for Texas from ACESA 2009 (Difference Between Baseline Case and ACESA Reference Case Carbon Prices)**



Source: CEE using output from REMI-PI

**Figure 7. Projected Impacts for US from ACESA 2009 (Difference Between Baseline Case and ACESA Reference Case Carbon Prices)**



Source: CEE using output from REMI-PI

In the high carbon price case, annual job losses in Texas could average about 300,000 between 2012 and 2020 and about 370,000 per year between 2021 and 2030. For the 2012 to 2030 time frame, losses in gross state product and real disposable personal income are near or above \$30 billion a year initially, and \$50-60 billion in later years. The table below provides more detail on percent changes for the ACESA reference and high cases for Texas and the US.

**Table 3. Percent Changes, Reference and High Cases, Texas and US**

*(Percent differences between baseline case and ACESA reference case, and base case and ACESA high case, using NBCC/CRA August 2009 inputs)*

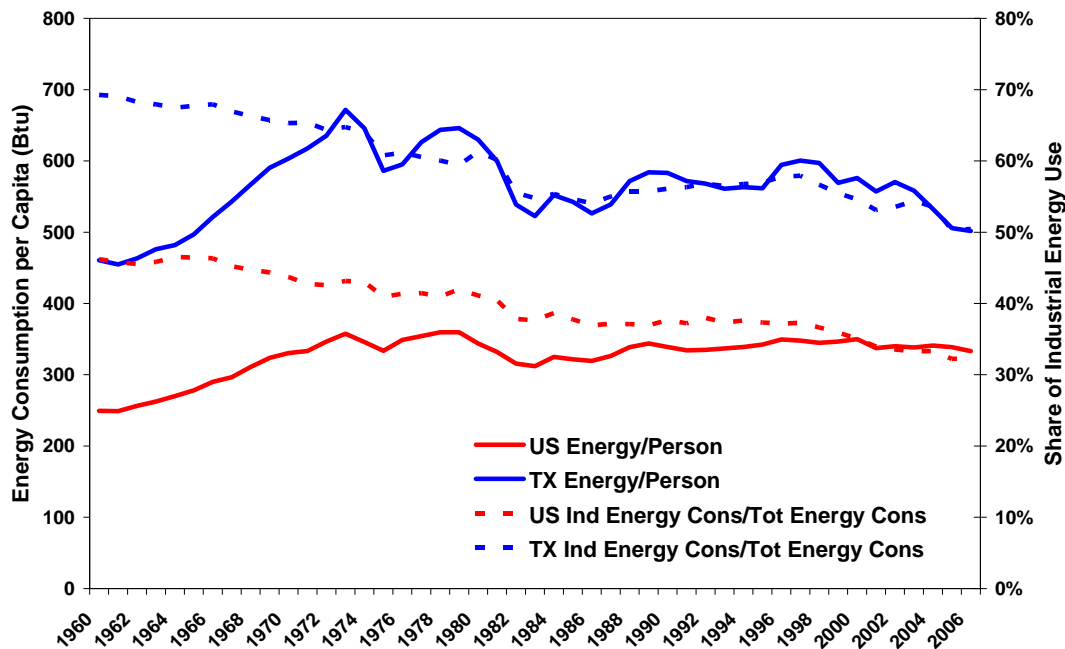
Category	Texas				US			
	2012	2015	2020	2030	2012	2015	2020	2030
<b>Reference Case Carbon Prices:</b>								
Total Employment	-1.07	-0.98	-0.94	-1.15	-1.11	-1.06	-1.05	-1.38
Gross State/Domestic Product	-1.11	-1.13	-1.24	-1.68	-1.18	-1.23	-1.35	-1.91
Real Disposable Personal Income	-0.72	-0.74	-0.75	-0.88	-0.70	-0.82	-0.91	-1.21
<b>High Case Carbon Prices:</b>								
Total Employment	-2.21	-2.08	-2.14	-2.84	-2.31	-2.25	-2.38	-3.34
Gross State/Domestic Product	-2.28	-2.34	-2.66	-3.78	-2.44	-2.56	-2.92	-4.28
Real Disposable Personal Income	-1.49	-1.56	-1.68	-2.15	-1.45	-1.73	-2.03	-2.88

The overall effect of establishing caps on emissions, even with free allowances, is to push costs up for directly affected industries (forcing technology, efficiency or business model responses or shut downs); for other energy consuming businesses (triggering declines in business income, which affects hiring); and for energy consumers (reducing personal disposable income, which affects the ability of consumers to make other purchases and thus exacerbates industry and business revenue losses). All of these impacts and feedbacks for both the state and nation trigger overall employment losses as well as economic and income effects. Importantly, reduced industry, business and personal income translate to reduced revenues for Texas and the US, impacting public and social welfare programs.

Industries that are more capital and energy intensive, rather than labor intensive, encompass larger shares of the Texas economy than for the nation as a whole. This is illustrated in Figure 8 below, which compares industrial energy use as a share of total energy consumption and energy use per person for Texas and the US. The bulk of the heavy, energy intensive industry in Texas makes energy fuels and hydrocarbon-based materials and products and exports these to the rest of the US. As a result of the Texas economic structure, employment losses are somewhat tempered relative to the national trend, especially in later years. But the projected decline in real (inflation adjusted) gross state product associated with these

industries is more pronounced than state employment affects, and is associated with the decline in production of and export of more GHG intensive products as ACESA provisions take hold.

**Figure 8. Comparison of Industrial Energy Consumption (As Share of Total Energy Consumption, Btu) and Energy Consumption per Capita (Percent) for Texas and the US**



Texas constitutes about eight percent of the United States economy. In July 2009 Texas employment was about 11 million while employment in the United States was about 141 million. The unemployment rate for Texas in July 2009 was 8.2 percent, while the unemployment rate for the US as a whole was 9.7 percent.<sup>11</sup> Texas real GDP in 2007 was about \$903 billion and real disposable personal income about \$674 billion. For the US, real GDP in 2007 was about \$11.5 trillion and real disposable personal income about \$8.6 trillion. All dollar amounts are fixed to 2000.

It is important to emphasize that these model results do not incorporate any assumptions about specific benefits associated with ACESA. For instance, CEE and CPA did not attempt to capture job creation and economic output associated with growth in specific industries, such as renewable energy technology and energy efficiency businesses. Nor did we attempt to isolate specific economic losses in industries that are likely to be more heavily impacted. Modeling isolated, industry and sectoral effects is fraught with difficulty and prone to error.

<sup>11</sup> Texas Workforce Commission estimates, <http://www.twc.state.tx.us/news/press/2009/052209epress.pdf>.

The carbon cost adjustments do reflect added expense to industrial, commercial and household customers as these kinds of shifts begin to occur with GHG caps. With implementation of ACESA, a series of responses begins to filter throughout the US and Texas economies. First, and most directly, the imposition of emissions constraints and the prospect of ever increasing caps in the future do affect the cost of energy supplies – even with free allowances, offsets and other mitigation options (many of which entail public spending obligations). In addition, our carbon price adjustments reflect the cost of mandates designed to push renewables further into the US energy mix (embedded in the NBCC/CRA assumptions and results). Public spending obligations include items such as tax credits, typically used to underwrite investment costs for renewable energy systems, loan guarantees and other mechanisms. Finally, the cost of energy delivered from wind and solar power projects tends to be higher because of the intermittent nature of the energy source and thus new requirements placed on managing transmission and reliability. These requirements and associated higher costs will remain in place until cost effective, scalable technology solutions can be developed and implemented.

We also have not attempted to evaluate specific unintended consequences of ACESA. For instance, pressure to meet emissions caps would, in all likelihood, trigger the much discussed “dash for gas” in the US. As the largest producer and supplier of natural gas among the Lower 48 states, much of the drilling and natural gas delivery investment would take place in Texas. Texas also hosts significant new liquefied natural gas (LNG) import receiving terminal capacity. Upward pressure on natural gas prices could offset other revenue losses for the State, but higher natural gas prices also impact businesses and consumers. The impact associated with higher natural gas prices would be stronger with the imposition of carbon allowance costs. The resulting downward pressure on natural gas demand would offset volumes of natural gas used as consumers responded to higher price signals. These are the types of complex interactions that are difficult to capture.

In sum, a key question for any economic analysis of ACESA or similar proposals is whether the economic costs associated with fundamental changes in the US energy supply portfolio can be balanced with sufficient economic growth from new businesses and jobs of comparable or greater wage and salary profiles to at least neutralize detrimental impacts. Considerable debate exists regarding the emergence of “green” jobs and industries that could replace other economic activities and offset job and income losses (see section below, Are There Potential Benefits from ACESA? The “Green” Jobs Debate). Moreover, going forward, a critical issue will be whether other nations adopt similar GHG mitigation strategies so that, along with mitigating allowances provided in ACESA, US export industries continue to be competitive and thrive.

## **Benchmark Studies for Comparison**

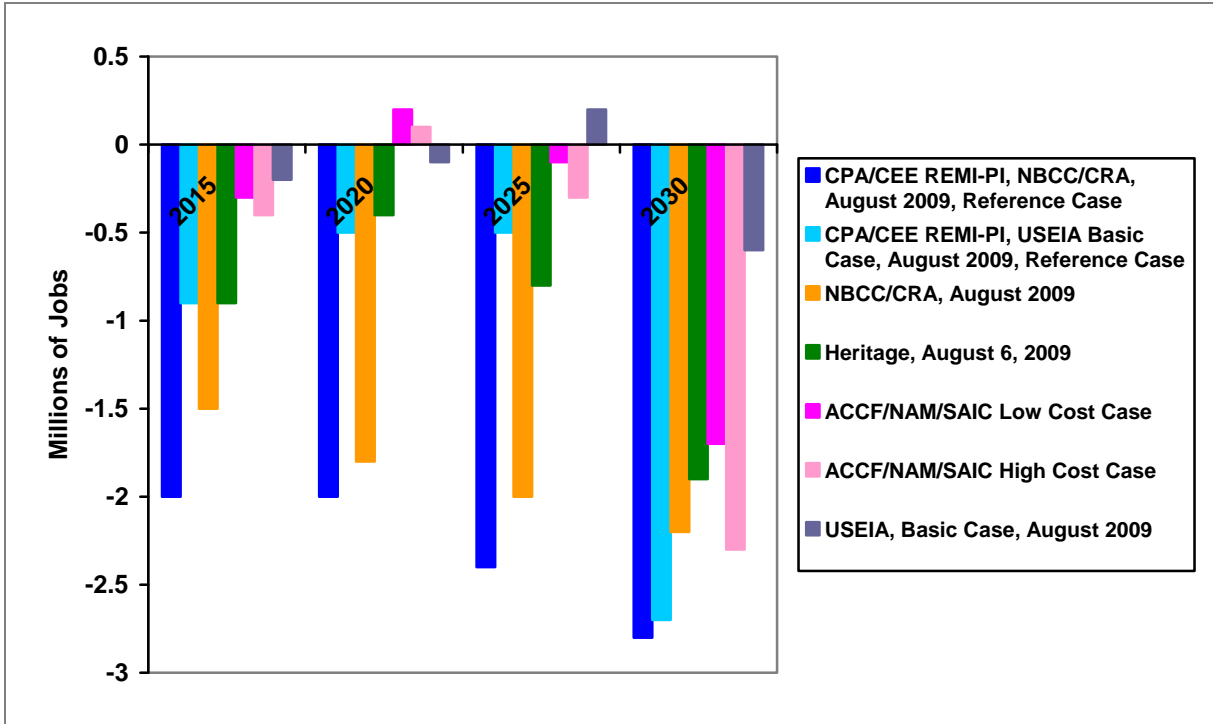
As noted earlier, CEE has peer-reviewed numerous other studies in order to establish benchmarks for the CPA/CEE modeling results. The previous Table 2 provides a snapshot of the studies we reviewed. Table 4 below captures the main assumptions used and outputs from the various studies on ACESA as passed by the House for comparison. Graphic comparisons of the various CPA/CEE results and benchmark studies are shown in Figure 9 and Figure 10 below. CPA conducted a

separate run of REMI-PI using the USEIA ACESA assessment released in August 2009. The inputs (carbon prices, price projections and energy consumption) and results from that test are included in the tables and figures below for comparison with the REMI-PI results using the NBCC/CRA report.

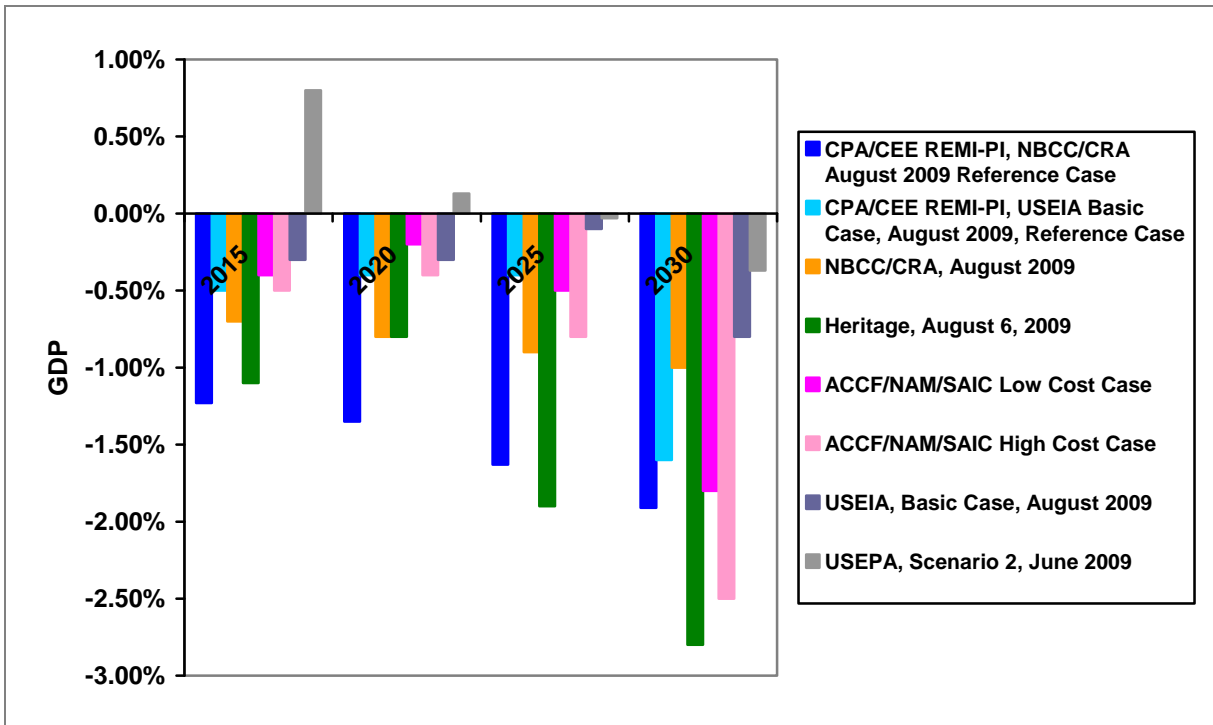
**Table 4. CPA/CEE Reference Case and Benchmark Studies, US Effects Only**

	2012	2015	2020	2025	2030
<b><i>Changes in Employment from Base Case (millions of jobs)</i></b>					
CPA/CEE REMI-PI, NBCC/CRA, August 2009, Reference Case	-2.0	-2.0	-2.0	-2.4	-2.8
CPA/CEE REMI-PI, USEIA Basic Case, August 2009, Reference Case	-0.3	-0.9	-0.5	-0.5	-2.7
NBCC/CRA, August 2009	NA	-1.5	-1.8	-2.0	-2.2
USEIA, Basic Case, August 2009	0.1	-0.2	-0.1	0.2	-0.6
Heritage, August 6, 2009	-1.9	-0.9	-0.4	-0.8	-1.9
ACCF/NAM/SAIC Low Cost Case	0.1	-0.3	0.2	-0.1	-1.7
ACCF/NAM/SAIC High Cost Case	0.0	-0.4	0.1	-0.3	-2.3
USEPA, Scenario 2, June 2009	No employment effects reported.				
<b><i>Changes in GDP from Base Case</i></b>					
CPA/CEE REMI-PI, NBCC/CRA, August 2009, % and \$2000 billions	-1.2% \$-151	-1.2% \$-173	-1.4% \$-219	-1.6% \$-301	-1.9% \$-402
CPA/CEE REMI-PI, USEIA Basic Case, August 2009 % and \$2000 billions	-0.2% \$-20	-0.5% \$-75	-0.4% \$-59	-0.4% \$-69	-1.6% \$-336
NBCC/CRA, August 2009	NA	-0.7%	-0.8%	-0.9%	-1.0%
USEIA, Basic Case, August 2009, % and \$2000 billions	0.1% \$9	-0.3% \$-38	-0.3% \$-50	-0.1% \$-22	-0.8% \$-161
Heritage, August 6, 2009, % and \$2000 billions	-1.3% -158	-1.1% -130	-0.8% -129	-1.9% -310	-2.8% -550
ACCF/NAM/SAIC Low Cost Case, % and \$2000 billions	-0.0% -2	-0.4% -50	-0.2% \$-33	-0.5% \$-93	-1.8% \$-349
ACCF/NAM/SAIC High Cost Case, % and \$2000 billions	-0.1% \$-7	-0.5% \$-71	-0.4% \$-57	-0.8% \$-137	-2.5% \$-477
USEPA, Scenario 2, June 2009, % and \$2005 billions	NA	0.8% \$13	0.13% \$23	-0.03% \$-5	-0.37% \$-83

**Figure 9. US Total Employment Losses, Benchmark Studies**  
*(Difference between baseline cases and cases including ACESA)*



**Figure 10. US Gross Domestic Product Losses, Benchmark Studies**  
*(Difference between baseline cases and cases including ACESA)*



As shown by the preceding table and figures, while the losses indicated in our CPA/CEE model runs are substantial, they are mostly in line with the findings of other studies. This is especially true of 2030 job losses and thus employment effects in outer years. GDP results are more variable. The results from Heritage and ACCF/NAM/SAIC are considerably more aggressive by the 2030 time period.

Overall, the US government and, in particular, USEPA analyses are much more optimistic than any of the other studies reviewed. USEPA prepared an initial analysis of the draft HR 2454 in April 2009 and released an updated memo (May 17) as ACESA revisions emerged during bill mark up. Additional changes were made following House passage of ACESA in May. Using two different modeling approaches, USEPA initially produced carbon price ranges of \$13-28 and \$17-36 from 2015-2030. In its May 17 update memo, EPA suggested that given changes in ACESA from the initial Waxman-Markey draft, including expansion of free allowances and increased opportunities for offsets, carbon prices would be even lower and economic effects negligible.<sup>12</sup> The June 2009 results fall below the bottom of these ranges. Furthermore, and notably, USEPA's analysis is based on the USEIA Annual Energy Outlook released in March 2009. The USEIA released an April 2009 revision that incorporates the deeper recession effects and the ARRA; USEIA used this revised AEO as the basis for their own analysis of ACESA. (For comparison, Heritage used the November 2008 Global Insight forecast; NBCC/CRA used both the March and April 2009 releases of USEIA AEO; ACCF/NAM/SAIC uses the April release). The USEPA also assumes that offsets and the "looseness" of caps will moderate carbon prices. It appears that the agency has very optimistic views regarding introduction of mitigation technologies (in particular, CCS and renewables) given the carbon allowance prices embedded in the modeling. For that matter, USEIA's analysis also appears to accommodate rapid and large technology responses. USEPA's fuel cost impacts, as a consequence, are considerably less than CPA/CEE scenarios. Both USEPA and USEIA produced multiple scenarios, including, for USEIA, much more pessimistic futures. We have only used the scenarios considered by the agencies to be their reference cases. Table 5 provides a summary of key input and output variables from benchmark studies for comparison.

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<sup>12</sup> All US EPA documents available at <http://www.epa.gov/climatechange/economics/economicanalyses.html#wax>.

**Table 5. Carbon Allowances and Energy Price Increase, Benchmark Studies**

*(Energy price increases are percent differences between baseline case and ACESA cases)*

	2015	2020	2025	2030
<b>Allowance Price, \$/ton CO2 equivalent</b>				
CPA/CEE NBCC/CRA August 2009, Reference Case (\$2008)	24.00	30.00	39.00	49.00
CPA/CEE USEIA, Basic Case, August 2009 (\$2007)	22.22	31.75	45.37	64.83
NBCC/CRA, August 2009, Reference Case (\$2008)	24.00	30.00	39.00	49.00
USEIA, Basic Case, August 2009 (\$2007)	22.22	31.75	45.37	64.83
Heritage (\$nominal)	20.00	35.80	93.90	151.40
ACCF/NAM, Low Case (\$2007)	29.50	47.50	76.50	123.21
ACCF/NAM, High Case (\$2007)	38.03	61.24	98.63	158.85
USEPA, Scenario 2, June 2009 (\$2005)	12.64	16.31	20.78	26.54
<b>% Electricity Price Increase</b>				
CPA/CEE NBCC/CRA (residential)	11	14	19	24
CPA/CEE USEIA (residential)	4	3	2	18
NBCC/CRA (household)	12	18	NA	24
USEIA (residential)	3	7	8	29
Heritage (retail)	No baseline price information provided.			
ACCF/NAM, Low Case (residential)	4	5	5	31
ACCF/NAM, High Case (residential)	5	8	11	50
USEPA (delivered with allowance price)	11	13	14	13
<b>% Natural Gas Price Increase</b>				
CPA/CEE NBCC/CRA (residential)	9	12	15	20
CPA/CEE USEIA (residential)	2	3	4	18
NBCC/CRA (household)	11	13	NA	17
USEIA (residential)	-16	-6	-4	19
Heritage (avg. all sectors)	No baseline price information provided.			
ACCF/NAM, Low Case (residential)	15	-3	5	56
ACCF/NAM, High case (residential)	24	0	10	73
USEPA (delivered with allowance price)	7	9	9	10
<b>% Motor Gasoline Price Increase</b>				
CPA/CEE NBCC/CRA	7	9	13	16
CPA/CEE USEIA	4	6	8	9
NBCC/CRA	4	5	NA	7
USEIA (weighted avg.)	27	46	50	59
Heritage (pump price)	17	20	37	52
ACCF/NAM, Low Case (retail gasoline)	6	8	12	20
ACCF/NAM, High Case (retail gasoline)	8	11	16	26
USEPA (petroleum; delivered with allowance price)	3	4	5	6

Inconsistencies are to be expected as all of these studies are using different models with varying model structures and approaches and different assumptions and inputs. What is common across the NBCC/CRA, Heritage and CPA REMI-PI results, though, is the strong negative impact of additional costs associated with ACESA on employment and GDP, critical variables for the health of the US and Texas economies. As noted previously, the USEPA results diverge strongly from other studies. Presumably, based on the comparisons presented above, higher carbon cost assumptions (a result mainly of different energy supply and technology responses) would move EPA's analysis toward greater losses while lower carbon price impacts would reduce losses in NBCC/CRA, Heritage and CPA/CEE results. A

critical difference between USEPA and other economic assessments of ACESA is USEPA's assumption that other nations will enact comparable GHG mitigation policies, so that US manufacturing exports increase substantially after 2020.

Subsequent to work performed by CEE, on September 14, 2009, the US Congressional Research Service (CRS) released an extensive review of the same studies used by CEE and CPA for benchmarking.<sup>13</sup> The CRS review points to a number of general considerations, alluded to elsewhere in this report, with regard to the difficulty in modeling complex legislation such as ACESA. CRS notes that:

*"The various cases examined here do provide some important insights on the costs and benefits of H.R. 2454 and its many provisions.*

- *If enacted, the ultimate cost of H.R. 2454 would be determined by the response of the economy to the technological challenges presented by the bill.*
- *The allocation of allowance value under H.R. 2454 will determine who ultimately bears the cost of the program.*
- *The cases generally indicate that the availability of offsets (particularly international offsets) is potentially the key factor in determining the cost of H.R. 2454.*
- *The interplay between nuclear power, renewables, natural gas, and coal-fired capacity with carbon capture and storage technology among the cases emphasizes the need for a low-carbon source of electric generating capacity in the mid- to long-term. A considerable amount of low-carbon generation will have to be built under H.R. 2454 in order to meet the emission reduction requirement.*
- *Attempts to estimate household effects (or other fine-grained analyses) are fraught with numerous difficulties that reflect more on the philosophies and assumptions of the cases reviewed than on any credible future effect."*

CRS further notes that, in comparing the ACESA GHG reduction program to US experience with the sulfur dioxide (SO<sub>2</sub>) cap and trade scheme, "There is no reason to believe that cost estimates for greenhouse gas reductions will be any more accurate than the 1990 SO<sub>2</sub> estimates; indeed, they are likely to be less reliable. This is not to say that they will be too high; they may be too low."

The CRS review emphasizes a number of points made above with regard to differences across various analyses of ACESA impacts and implications.

- Results from different studies are ultimately dependent upon the underlying structure of the US economy as reflected in the baseline (no ACESA) scenarios. As noted previously, all of the studies use different forward projections of the US macroeconomy. The CRS report includes considerable discussion regarding whether general equilibrium (GE) effects matter, and whether analysis of ACESA should only focus on abatement cost. However, given the extent and pervasiveness of ACESA provisions, in our view it is not possible to separate these effects.

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<sup>13</sup> See [http://energy.senate.gov/public\\_files/R40809.pdf](http://energy.senate.gov/public_files/R40809.pdf).

- CRS properly notes that analyses of ACESA hinge on distinct views about future energy technologies and fuels. Indeed, as mentioned earlier, the federal agency reviews appear to be much more accepting of alternative energy technologies (renewables) and frontier technologies such as commercial scale CCS. However, timing of technology development and deployment is complex and cannot be viewed in isolation from the enormous hurdles associated with achieving meaningful additions of capacity and/or reaching commercial scale for certain technologies. In several reports, mention is made regarding public acceptance of low carbon technologies. None of the reports explicitly mention or elaborate on the enabling policy and regulatory frameworks that would have to be developed to support many of the future energy supply mix assumptions that are used. Finally, the CRS report also shines a light on energy research and development (R&D) and raises important questions about the extent to which ACESA targets specific technologies to the exclusion of others and whether this is an optimal approach for the US taxpayer resources that are obligated. In any case, beyond these considerations, there is the dilemma that even with robust federal support and large commitments of public investment, some technologies simply will not be able to compete with other fuels even with allowance prices.
- The degree to which the different modeling approaches vary regarding use of international offsets has substantial impact on projected outcomes. NBCC/CRA treat the use of offsets as a specific leakage from the US economy (a GE effect).
- As noted in the beginning of this report, ACESA incorporates a large number of regulatory mandates and requirements and would not preclude the USEPA or other agencies from enforcing rules that constitute costs and impacts in addition to ACESA direct provisions. CRS does not address this issue. Instead, the CRS report tends to focus on the "either/or" debate regarding enactment of ACESA and whether failure of Congress to pass a climate mitigate law would mean USEPA actions to use the Clean Air Act provisions to achieve GHG reductions.
- Nor does CRS address a fundamental question regarding the income redistribution components of ACESA. HR 2454 represents a considerable commitment in this regard, an attempt to soften the impacts on energy consumers and customers of the GHG caps. The cost in terms of economic efficiency would likely be significant; neither CRS's review of the various studies examined by CEE and CPA, nor the study reports themselves, take this consideration fully into account.
- Finally, the CRS review opens an interesting entrée into the purpose and objective of ACESA by raising questions about distinctly different viewpoints regarding GHG emissions and their potential effects. Analysis of ACESA, indeed analysis of GHG emissions reductions in general, is burdened by the lack of clear evidence and understanding regarding possible future implications. This clouds traditional cost-benefit assessments and complicates the identification of potential benefits associated with HR 2454. While CRS essentially concludes that, in the end, passage of ACESA may be defended on the basis of international cooperation and leadership, it is not clear how or whether that will be achieved. There may be many other better mechanisms for minimizing potential climate change impacts of human activities.

## **Are There Potential Benefits from ACESA? The “Green” Jobs Debate**

The most commonly cited claim with regard to potential benefits from ACESA is “green” job creation associated with overall investment in new energy sources. Some views are that creation of “green” jobs would offset job losses as Americans shift to lower carbon intensity energy fuels and technologies.

Energy efficiency and renewable resources will likely play an increasingly larger role in future energy policies. Wind technology is more or less established itself as part of the electricity generation mix with the help of government policies such as federal production tax credit. Newer technologies such as biofuels based on feedstock other than corn, advances in solar thermal and PV technologies, and electricity storage (e.g., compressed air energy storage) are in various stages of research and development. Differing technologies offer a varying array of benefits and trade-offs including cost structures, reliability of supply, and lower emissions. These are appropriate criteria to consider their desirability in future energy portfolios.

Often, however, creating “green” jobs is also offered as a benefit associated with investment in these “green” technologies. Clearly, such investment will create jobs as any other investment more during construction than operation; but it is often claimed that there are more jobs associated with alternative technologies when measured per unit of output or installed capacity as compared to conventional technologies (e.g., wind versus natural gas). This premise of extra benefit associated with “green” jobs is economically problematic. Excess job creation is in direct conflict with the overall goal of increasing productive efficiency and hence lowering cost of production. Alternative technologies may in part be more expensive than established technologies due to lack of economies of scale. Some of this cost disadvantage may be justified based on environmental and diversification benefits, but if they are also more labor-intensive and will remain so, their cost disadvantage may remain permanent.

But, one has to question economic criteria used to demonstrate job benefits of “green” technologies. Estimating economic impact, including creation of jobs, of any major investment scheme is difficult as multiplier effects can change over time and unintended consequences are often ignored. With green jobs, there are further complications such as their definition and assumed labor intensities. What jobs are considered green? Only renewables? Other alternatives? Are these new jobs or existing jobs reclassified as “green”? For example, “Train operators who currently deliver furniture may one day deliver wind turbine component parts, meaning that their work will be contributing to a green economy that solves global warming and builds healthier communities.”<sup>14</sup>

Jobs created are not always separated between construction jobs, which are temporary, and operation jobs, which are long-term. Maintenance jobs are usually

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<sup>14</sup> *Job Opportunities for the Green Economy: A State-by-State Picture of Occupations That Gain From Green Investments*, Robert Pollin & Jeannette Wicks-Lim, Political Economy Research Institute (PERI), University of Massachusetts, Amherst, June 2008

outsourced in many facilities (e.g., wind farms) and maintenance can be supplied by existing workforce that serves other industries; but it is not clear that studies acknowledge this industry practice.

Usually job destruction is not taken into account. Increased cost of energy (as renewables generate more expensive electricity) to businesses and households (less consumption) is often ignored. To the extent energy from alternative technologies reduce the demand for conventional sources of energy, employment in conventional industries will decrease. Recent reports that evaluated ACESA such as the NBCC/CRA International, Heritage and EIA studies referenced in this report, show that there will be an economic cost, including job losses, associated with cap & trade regulation (which is expected to promote renewables).

More fundamentally, the comparison of job creation is often based on flawed statistics as it looks at jobs per MW rather than jobs per dollar invested. An effort to correct for this bias is presented in Table below. The 'jobs per capacity' statistic reported in column (1) is often used to emphasize the job creation benefits of "green" technologies. But when one looks at jobs per dollar invested as reported in column (3), the difference is not that significant. In any event, from the perspective of productive efficiency (and lower cost), one should be going after less labor intensive technologies.

**Table 6. Job Creation Associated With Different Generation Technologies**

	(1)	(2)	(3)	(4)	(5)	(6)
	Jobs/MWa	Jobs/GWh	Jobs/\$MM	\$/KWh	MWh	\$
Solar PV	7.41	0.846	3.18	\$0.2664	7.80	1.55
Solar PV	10.56	1.205	4.53	\$0.2664	11.12	2.21
Wind	0.71	0.081	1.64	\$0.0495	0.75	0.80
Wind	2.79	0.318	6.43	\$0.0495	2.94	3.14
Biomass	0.78	0.089	1.80	\$0.0496	0.82	0.88
Biomass	2.84	0.324	6.54	\$0.0496	2.99	3.19
Coal	1.01	0.115	3.72	\$0.0310	1.06	1.81
Natural Gas	0.95	0.108	2.05	\$0.0529	1.00	1.00

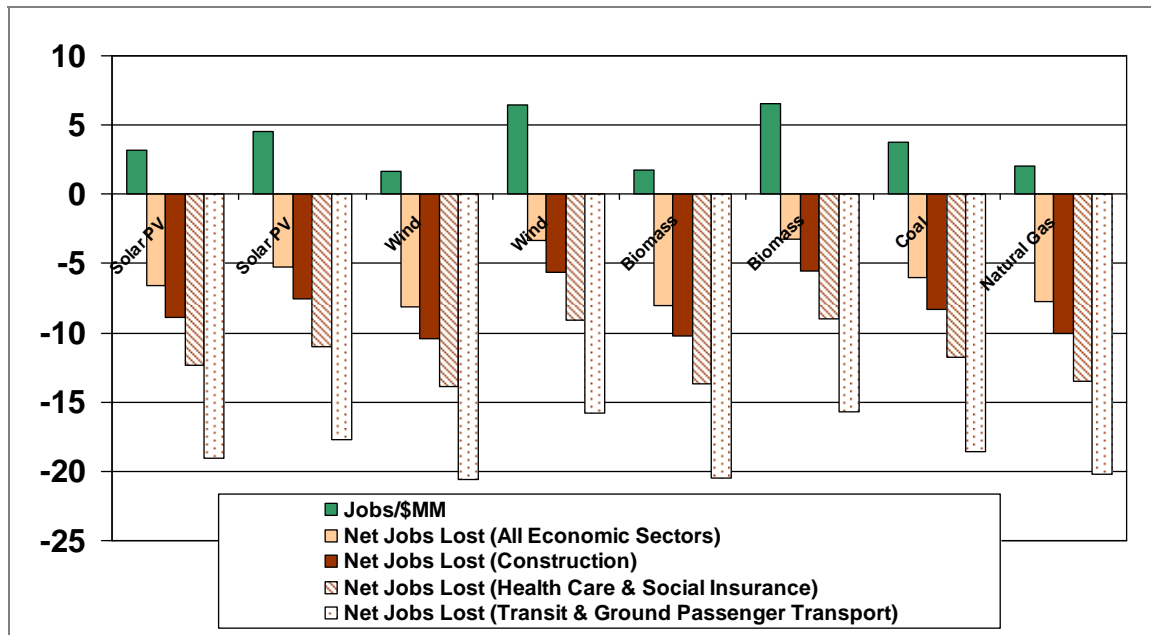
Explanation:  
 Column (1), source: Kammen, Kapadia & Fripp (2006).  
 Column (2) = column (1) \* (10<sup>6</sup>) / 8760.  
 Column (3) = column (2) / column (4).  
 Column (4), source: Metcalf (2005), converted from cents per KWh.  
 Columns (5) & (6): Jobs Index (where natural gas equals 1.00).  
 MW = megawatts = capacity.  
 MWa = used capacity averaged over the year = (% capacity factor) x (capacity).  
 GWh = 1000 \* megawatt hours = (1000) x (24 hours) x (365 days) x (% capacity factor) x (capacity).  
 GWh = MWa x 1000 x 8760.

From: "Creating Jobs with 'Green' Power Sources" by Hill Huntington, *USAAE Dialogue*, March 2009.

Moreover, the opportunity cost of "green" investment is almost always ignored. When a dollar is invested in alternative technologies, the same dollar is not available for other sectors. If the purpose of investing is to create jobs, there are

other sectors where the money could be spent more productively. In Figure 11 below, as compared to the overall economy and some sectors, investment in energy projects lead to job losses. "Net jobs" is the difference between jobs created with incentives in each activity minus US BEA estimates of jobs normally created per \$1 million invested but that are lost due to diverted investment.

**Figure 11. Jobs Gained and Lost with Incentive Programs**



CEE reconstruction based on "Creating Jobs with 'Green' Power Sources" by Hill Huntington, *USAEE Dialogue*, March 2009.

Overall, claims about "green" jobs appear to be exaggerated. An increasing number of studies show that there will be costs associated with a cap and trade system: higher energy cost, lower economic output and job losses. Investment in alternative technologies, which should pick up under carbon regulation, will create jobs but their numbers will not be high enough to compensate for losses due to higher costs.

### Other Issues for Consideration

As explained earlier, for this initial evaluation we focused only on direct CO2 cost impacts associated with ACESA. In further analysis, we may focus on potential losses in output for certain industries to better define the Texas situation. Also as mentioned previously, our current approach does not include any benefits associated with ACESA. Possible benefits would mainly extend from the potential for new industries and businesses (ranging from alternative energy equipment manufacturing to weather prediction and risk management approaches) to take hold as ACESA is implemented; these may offset some of the economic losses. The table below incorporates a number of recommendations and caveats for extending the current analysis, especially to track and monitor further developments as ACESA moves through the US House and ultimately the Senate. Importantly, ACESA is not isolated from other Federal actions. Consequently, in keeping with

previous discussions, the table below also includes a number of key Federal actions beyond ACESA that are of particular concern and should be considered by CPA, either for future modeling or to interpret and dissect potential implications for Texas.

**Table 7. Recommended Issues for Consideration by CPA**

Issue	Recommendations for CPA
<i>ACESA 2009 and major provisions:</i>	
Title III "cap and trade" – carbon equivalent allowances and projected prices	<ul style="list-style-type: none"> <li>• Consider impacts on specific Texas industry segments (would increased exports of natural gas lessen impacts on petroleum refining?), including non-energy sectors (for CO2 equivalent reductions and effects).</li> <li>• Consider potential mitigating effects associated with lower comparative costs for some energy fuels in Texas relative to US as a whole.</li> <li>• Consider possible benefits associated with allowances designed to stimulate alternative energy technologies, research and development (R&amp;D), etc.</li> </ul>
Title VIII and IX regulatory mandates and requirements	<ul style="list-style-type: none"> <li>• Consider costs to US and Texas businesses and industries associated with reporting and other administrative requirements.</li> <li>• Consider "drag" on US and Texas economies associated with increased Federal budget requirements for administrative costs.</li> </ul>
Title I and II spending programs and regulatory provisions	<ul style="list-style-type: none"> <li>• Consider benefits associated with investments in clean energy, CCS and other ACESA provisions.</li> <li>• Offsetting impact of administrative (regulatory and other) costs absorbed by businesses and industries associated with implementation of Title I and II provisions.</li> <li>• Impact of Federal budget requirements to fund and administer ACESA provisions.</li> </ul>
<i>ARRA 2009 and major provisions:</i>	
Federal economic stimulus programs	<ul style="list-style-type: none"> <li>• Benefits and costs (including administrative requirements and financial market responses to Federal budget deficits) of ARRA implementation. Potential to add to or detract from ACESA energy and climate provisions.</li> </ul>

Issue	Recommendations for CPA
<i>US Office of Management and Budget, proposed 2010 blueprint (passed by Congress, April 29, 2009; under appropriation and implementation by various Congressional committees and Federal departments)<sup>15</sup></i>	
Oil and gas taxes	<ul style="list-style-type: none"> <li>• Impacts of potential reductions in oil and gas tax credits as well as increases in costs on US and Texas oil and gas extractive industries.</li> </ul>
Consumer/customer tax increases	<ul style="list-style-type: none"> <li>• Impact on US and Texas employment and income associated with increased taxes on energy fuels related proposals to compensate for revenue losses associated with ACESA free allowances.</li> </ul>
Other energy and climate provisions.	<ul style="list-style-type: none"> <li>• Costs and benefits associated with non-ACESA provisions for clean energy, “green” jobs, R&amp;D, and other aspects of the President’s budget blueprint.</li> <li>• Indirect effect (jobs, investment) associated with potential increases in Federal oil and gas royalties and changes in offshore leasing practices, as well as other changes in how the Federal mineral estate is managed.</li> </ul>
<i>Financial and commodity market regulation and oversight (House Committee on Agriculture; Commodities and Futures Trading Commission – CFTC; US Department of Treasury; Securities and Exchange Commission – SEC; Federal Energy Regulatory Commission – FERC):</i>	
Proposals to increase oversight of financial derivatives and overall commodity market performance	<ul style="list-style-type: none"> <li>• Impact of proposals to increase transparency of financial derivatives trading on overall energy commodity prices and trading volumes, as well as on carbon prices and trading volumes, associated with increased regulatory and business costs on traders and other participants.</li> </ul>
<i>US EPA:</i>	
Non-ACESA actions by EPA related to emissions reporting and mitigation	The Administrator has substantial discretion in defining what emission limits should be set, and what sections of the act she might use to control GHGs. Greenhouse gases could be defined as criteria air pollutants, or not. They could be controlled in mobile sources of all kinds. They could be subject to New Source Performance Standards (NSPS), Prevention of Significant Deterioration (PSD), or Maximum Available Control Technology (MACT) requirements. Each of these has its

<sup>15</sup> See <http://www.whitehouse.gov/omb/budget/> for key components.

Issue	Recommendations for CPA
	<p>own standard-setting process and criteria.</p> <p>Impact of increased costs, including Federal administrative costs, for EPA to implement additional GHG and non-GHG emissions reporting and mitigation requirements.</p>
<p>Safe drinking water and oil and gas drilling operations</p>	<ul style="list-style-type: none"> <li>• Impact of proposals to stiffen regulation of drilling fluids (components of materials used in fracing and other operations) on oil and gas industry costs and production, including activity in Texas. Emphasis on natural gas supply impacts to meet demand associated with economic recovery and growth as well as ACESA provisions.</li> </ul>