TEXAS PUBLIC POLICY FOUNDATION

THE TEXAS ECONOMY:

How Would Climate Change Legislation Impact Economic Growth and Jobs?

FEBRUARY 2010

Prepared for the Texas Public Policy Foundation

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Executive Summary

Pending federal climate change bills would likely cause the Texas economy to experience slower growth in jobs and income. Texas' gross state product (GSP), employment, industrial output, state budget revenues, and household income would fall relative to the baseline forecast. Higher energy costs resulting from the Waxman-Markey bill's mandatory carbon emission reductions, energy efficiency mandates, and renewable portfolio standards (RPS) passed by the U.S. House of Representatives will impede recovery from the current recession and reduce state budget receipts. In recent years, each 1 percent increase in growth of gross domestic product (GDP) in the U.S. has been accompanied by a 0.2 percent increase in energy use. Thus, policies which raise energy prices are likely to have negative consequences for U.S. economic growth.

This paper describes recent economic and energy trends in Texas and provides details on the impact of federal climate bills such as the Waxman-Markey bill on the state. Comparable economic impacts could arise from enactment of a similar bill by Congress or from U.S. Environmental Protection Agency regulation of greenhouse gas emissions under the Clean Air Act.

Background on Study

Texas' real economic growth rate over the last decade (38.8 percent) has substantially outperformed that of the U.S. (28 percent). Over the same period, total employment has grown by 25 percent in Texas, substantially faster than the 14 percent increase for the U.S. as a whole. Texas' economy has benefited particularly from the strength of its oil and gas extraction sector (which is categorized as "mining" in the government statistics) and from manufacturing. Over the last decade, employment in Texas's mining sector has increased over 52 percent. In fact, approximately 14 percent of Texas' GSP is derived from energy production and energy intensive sectors.

The U.S. Congress is considering far-reaching climate change legislation that would impose a cap-and-trade system requiring sharp reductions in greenhouse gases (GHGs) and mandate high levels of energy efficiency and renewable energy. Both the Waxman-Markey bill (HR 2454) and the Kerry-Boxer bill (S.1733) would require reductions in GHGs beginning in 2012. The emission reduction targets would require a reduction of as much as 20 percent below 2005 levels in 2020 and an 83 percent reduction in 2050. Multiple economic analyses show that these federal climate bills would increase the price of electricity, gasoline, and natural gas. Although historically among the strongest economic sectors in Texas, manufacturing and energy production are particularly vulnerable to adverse impacts from federal climate change bills. The manufacturing sectors would be most impacted; it is likely there would be some relocation of energy intensive and trade exposed sectors to countries which do not impose mandatory GHG reductions.

Economic Impact of Climate Change Legislation

- If a cap-and-trade climate change bill similar to the Waxman-Markey bill (HR 2454) or the Kerry-Boxer bill (S.1733) is enacted, Texas is likely to experience a decrease in manufacturing output based on a macroeconomic analysis of HR 2454. Overall manufacturing output declines by 4.6 percent in the low cost case and by 5.4 percent in the high cost case in 2030 compared to the baseline forecast **(see Figure A)**.

- Texas now derives 47 percent of its electricity from natural gas and 38 percent of it from coal. Without commercially available, cost-efficient carbon control technology, Texas' electricity prices for a typical household could be 54 percent higher in 2030 under the Waxman-Markey bill.

- Another important segment of Texas' manufacturing industry, chemical product manufacturing, will decline by up to 14 percent in 2030. Certain energy intensive sectors like primary metals (e.g., the smelting and refining of ferrous and non-ferrous metals and alloys usually to make ingots) and nonmetallic mineral product manufacturing (e.g., bricks, cement, glass) also decline by as much as 19 percent to 26 percent in 2030. Coal production falls by 86 to 87 percent.

- Gross state product will decline by $29.9 billion to $40.8 billion in 2030. Such reductions in GSP will reduce state budget receipts and force policymakers to make hard choices.

- Texas will see a reduction in job growth; there will be 144,597 to 196,928 fewer jobs in 2030 **(see Figure B).** Employment in key manufacturing sectors, e.g., chemical products and fabricated metal, would see the greatest decline relative to the baseline forecast **(see Table 8)**.

- Disposable income will fall by an average of $612 to $1,103 in 2030. Low-income families and the elderly will spend a higher proportion of their income on energy.

Figure A. Change in Texas Output by Major Industry in 2030 (percent)

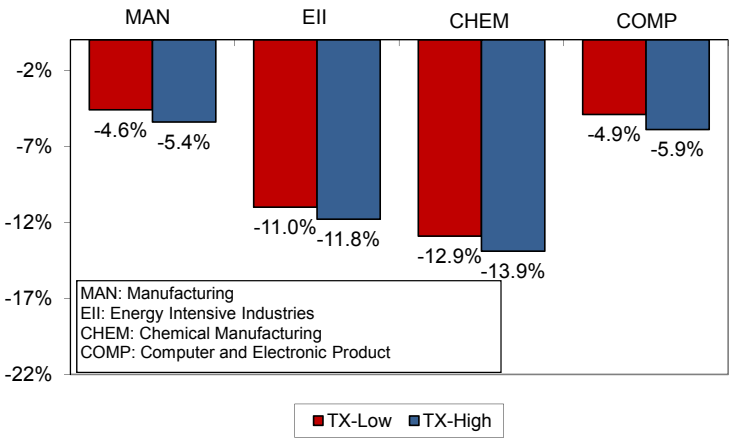
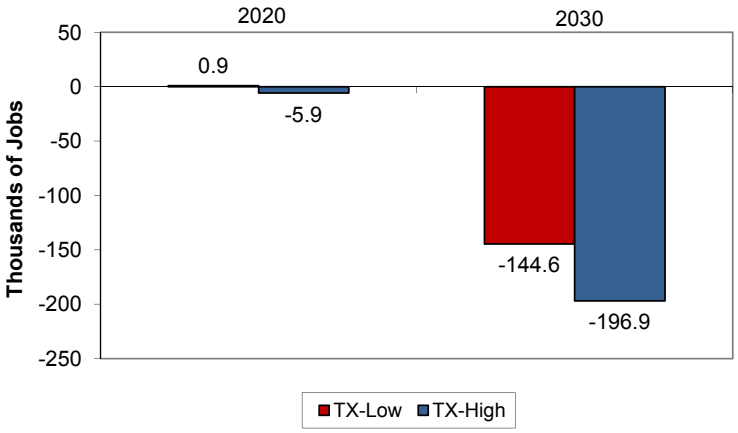


Figure B. Loss in Employment in Texas



THE TEXAS ECONOMY:
How Would Climate Change Legislation Impact Economic Growth and Jobs?

Introduction and Overview

As the debate over climate change policies continues among policymakers at the federal as well as the state and local levels, it is important for individuals, the business community, government officials, and the media to understand the potential economic impacts on their state. For example, the Waxman-Markey bill, The American Clean Energy and Security Act of 2009 (HR 2454) which passed in the U.S. House of Representatives in June 2009, requires large reductions in greenhouse gas emissions, renewable portfolio standards for utilities, and increases in energy efficiency across all sections of the economy. In recent years, each 1 percent increase in GDP growth in the U.S. has been accompanied by a 0.2 percent increase in energy use. Thus, policies which raise energy prices are likely to have negative consequences for U.S. economic growth.

The Waxman-Markey bill would have far-reaching impacts on states, including Texas, by raising energy prices, accelerating the use of renewable energy, and dictating higher levels of energy efficiency by households, business, and government. In the Senate, S. 1733, the Clean Energy Jobs and American Power Act, was voted out of the Committee on Environment and Public Works. The bill is similar to Waxman-Markey (HR 2454). This paper provides an overview of the current Texas economy and describes what changes, in terms of employment and income and other economic variables, can be expected if HR 2454 or a similar climate change bill is enacted by the 111th Congress. The economic impacts of climate policy legislation on Texas described here are based, in part, on an earlier analysis of the Waxman-Markey bill sponsored by the American Council for Capital Formation and the National Association of Manufacturers (see http://www.accf.org/publications/126/accf-nam-study for the earlier report). Regulation of GHGs by the U.S. Environmental Protection Agency under the Clean Air Act could also have significant negative consequences on economic and job growth.

Recent Economic Trends in Texas

Economic Growth and Real GDP by Industry

Texas' real economic growth rate over the last decade (38.8 percent) has substantially outperformed that of the U.S. (28 percent). As the U.S. economic recession took hold, Texas' economy grew at a lower rate in 2008 (2 percent) than in 2007 (4.4 percent) while the U.S. economy grew at a rate of only 0.7 percent in 2008. However, economic growth in 2008 was higher in Texas compared to the United States. Declines in output in 2008 in three key industries—nondurable manufacturing (e.g., food, beverages, textiles, petroleum refining, chemicals, and plastics) fell by 6.3 percent; agriculture, forestry, fishing, and hunting by 4 percent; and transportation and warehousing by 2.4 percent—were responsible for the state's slower growth in output. Two industries that had considerable increases in their output in 2008 were professional and technical services at 10.7 percent and management of companies and enterprises at 7.1 percent **(see Table 1)**.

Role of Oil and Gas, Mining and Chemistry Industries in Texas' Economy

Oil and Gas

Texas is the leading oil* and gas producing state and is responsible for approximately 22 percent of total U.S. production of crude oil and 30 percent of total U.S. natural gas production. A 2009 study by PricewaterhouseCoopers LLP, conducted for the American Petroleum Institute, demonstrated the importance of the oil and natural gas industry at the national and state levels. Among the industries included in the PWC report are oil and gas extraction, petroleum refining, pipeline transportation, gasoline stations, etc. The industry directly or indirectly supported 7.8 million jobs at the national level and 1.8 million jobs in Texas in 2007 **(see Table 2)**. The industry's total value-added contribution was almost $1 trillion nationally and $293 billion in Texas for the same year.

* Louisiana surpasses Texas when production from the Louisiana section of the federally administered Outer Continental Shelf is included.

Table 1. Texas Real Gross Domestic Product by Industry (millions of chained 2000 dollars)

	1998	2007	2008	Change 98-07	Change 98-08	Change 07-08
All industry total	666,590	907,358	925,505	36.1%	38.8%	2.0%
Private industries	590,540	819,414	834,618	38.8%	41.3%	1.9%
Agriculture, forestry, fishing, and hunting	4950	7753	7443	56.6%	50.4%	-4.0%
Mining	49083	43640	43478	-11.1%	-11.4%	-0.4%
Oil and gas extraction	43,758	36,471	NA	-16.7%	NA	NA
Mining, except oil and gas	690	618	NA	-10.4%	NA	NA
Support activities for mining	5,109	6,028	NA	18.0%	NA	NA
Utilities	17173	28649	28384	66.8%	65.3%	-0.9%
Construction	33,424	32,666	34,049	-2.3%	1.9%	4.2%
Manufacturing*	90,240	146,804	143,542	62.7%	59.1%	-2.2%
Durable goods	46785	97902	100107	109.3%	114.0%	2.3%
Nonmetallic mineral product manufacturing	3,601	4,522	NA	25.6%	NA	NA
Primary metal manufacturing	1,816	2,535	NA	39.6%	NA	NA
Fabricated metal product manufacturing	8,017	11,103	NA	38.5%	NA	NA
Machinery manufacturing	7,274	14,868	NA	104.4%	NA	NA
Computer and electronic product manufacturing	13,169	59,969	NA	355.4%	NA	NA
Nondurable goods	44001	54227	50787	23.2%	15.4%	-6.3%
Petroleum and coal products manufacturing	7,213	4,548	NA	-36.9%	NA	NA
Chemical manufacturing	16,341	33,493	NA	105.0%	NA	NA
Plastics and rubber products manufacturing	3,685	4,214	NA	14.4%	NA	NA
Wholesale trade	47,860	64,099	64,157	33.9%	34.1%	0.1%
Retail trade	46,040	74,029	75,070	60.8%	63.1%	1.4%
Transportation and warehousing, excluding Postal Service	24,659	37,398	36,517	51.7%	48.1%	-2.4%
Information	29738	51612	54558	73.6%	83.5%	5.7%
Finance and insurance	36979	55619	55739	50.4%	50.7%	0.2%
Real estate and rental and leasing	67,052	82,070	84,666	22.4%	26.3%	3.2%
Professional and technical services	41239	66788	73938	62.0%	79.3%	10.7%
Management of companies and enterprises	3056	11332	12135	270.8%	297.1%	7.1%
Administrative and waste services	22782	28753	30076	26.2%	32.0%	4.6%
Educational services	3049	4130	4348	35.5%	42.6%	5.3%
Health care and social assistance	36,852	52,180	54,689	41.6%	48.4%	4.8%
Arts, entertainment, and recreation	4024	5490	5664	36.4%	40.8%	3.2%
Accommodation and food services	17230	21880	22633	27.0%	31.4%	3.4%
Other services, except government	17600	17869	18139	1.5%	3.1%	1.5%
Government	76,051	88,759	91,623	16.7%	20.5%	3.2%

* Only key Texas industries are shown under manufacturing thus lines do not add to total for manufacturing.
Source: Regional Economic Accounts, Bureau of Economic Analysis, U.S. Department of Commerce.

Table 2. The Economic Impact of the Oil and Natural Gas Industry, 2007

	Texas	U.S.
Employment	1,772,335	7,818,437
Direct	432,147	2,123,291
Indirect	421,747	1,661,138
Induced	918,441	4,034,007
Value Added ($ Millions)	293,760	915,370
Direct	185,760	456,971
Indirect	42,108	158,934
Induced	65,893	299,464
Labor Income ($ Millions)	140,941	477,249
Direct	77,924	199,344
Indirect	24,742	97,947
Induced	38,276	179,958

Source: The Economic Impacts of the Oil and Natural Gas Industry on the U.S. Economy: Employment, Labor Income and Value Added," PricewaterhouseCoopers, September 8, 2009.

The oil and gas industry's contribution to state budget revenues is also very important. According to a report by the Texas Oil and Gas Association, the industry paid an estimated $9.9 billion in taxes and royalties into state and local coffers in fiscal year 2008.[1]

Non-Oil and Gas Mining Sector

The Texas economy benefits from its considerable mining resources. The state has substantial coal production and coal is the second largest energy source for electricity generation in the state. Texas is the fourth largest producer of clay and the state mines other resources

Table 3. Economic Impact of Mining in Texas Economy, 2007

	Coal Mining		Metal Mining		Nonmetallic Mineral Mining**		Total Mining	
	Output ($ million)	Employment	Output ($ million)	Employment	Output ($ million)	Employment	Output ($ million)	Employment
Direct	850	4,430	1,150	2,410	1,800	16,870	3,800	23,710
Indirect	2,180	22,040	2,500	12,560	3,820	31,110	8,500	65,710
In-state	880	12,230	1,220	6,370	1,900	14,660	4,000	33,260
Out-of-state*	1,300	9,810	1,280	6,190	1,920	16,450	4,500	32,450
Total	3,030	26,470	3,650	14,970	5,620	47,980	12,300	89,420

* generated within the state from mining activity occurring outside the state.
** Nonmetallic mineral mining includes stone quarrying, sand, gravel and other nonmetallic minerals such as clays, mica, salt, gemstones, and feldspar among others.
Source: "The Economic Contributions of U.S. Mining in 2007 Providing Vital Resources for America," Prepared for National Mining Association, February 2009.

such as uranium, granite, limestone, and gypsum etc. A 2009 study by Moore Economics, conducted for the National Mining Association, quantified the mining industry's contribution to state employment and output (see Table 3). According to the study, overall mining activity in 2007 contributed a little over $12.3 billion in Texas' economy when calculations include the multiplier effects of impacts on other industries. The industry's total contribution to employment (including direct and indirect employment effects) was 89,420. Nonmetallic mineral mining accounted for almost half of the impact, directly or indirectly supporting 47,980 in employment and $5.6 billion in output.

Chemistry Industry

Texas is among the top chemical producers in United States, along with Louisiana, New Jersey, North Carolina, and Illinois.[2] The state's economy benefits considerably from this sizeable industry. According to the American Chemistry Council, chemistry companies directly employ 74,304 people and indirectly contribute 391,944 jobs to the state's economy.[3] The average wage in the chemistry industry is 52 percent higher than the average manufacturing wage in the state. The industry's direct and indirect jobs generate $909 million in state and local taxes.

Employment in the State

Over the 1998-2008 period, total employment has grown by 25 percent in Texas, substantially faster than the 14 percent increase for the U.S. as a whole. In 2008 overall employment in Texas grew at a rate of 3.2 percent. The positive impact of oil and gas extraction and support for mining activities (e.g., services required for extracting oil, gas, and mineral mining) can be seen in the breakdown of state employment data for the mining industry (where oil and gas extraction is classified in government statistics). Over the last decade, employment in Texas' mining industry increased by 52.1 percent.

In 2008, mining employment increased by 48,756 workers, a 15.7 percent increase from 2007 levels (see Table 4). For the U.S. as a whole, mining employment increased by only 14.2 percent in 2008 and 39.4 percent over the last decade. Though the contribution of oil and gas to state GDP has declined somewhat over the last decade, there has recently been a surge in mining employment, in part because of increased drilling activity (due to higher oil and gas prices) and in part due to further development of unconventional oil and gas shale, such as the Barnett Shale in Texas.

Unemployment Rates in Texas Compared to the U.S.

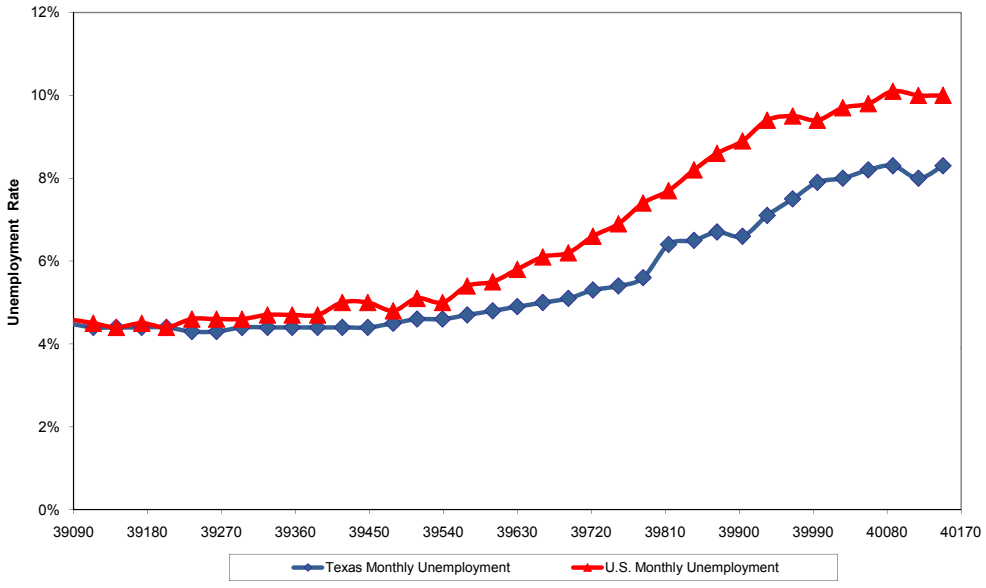
During the current recession, the Texas economy has fared better than the U.S. as a whole. According to the National Bureau of Economic Research, the current recession began in December 2007. Figure 1 shows that the unemployment rate in Texas has consistently been below the U.S. unemployment rate. Texas' seasonally adjusted unemployment rate has been rising slowly since February, reaching 8.3 percent in December 2009. The largest increase was in January 2009, when the unemployment rate jumped to 6.4 percent, a 0.8 percentage point increase from 5.6 percent in December 2008. Over the last 10 years, the average unemployment rate in Texas was slightly higher than the U.S. rate (5.2 percent versus 5 percent).

Table 4. Texas Employment by Industry, 1998-2008

	1998	2007	2008	Change 98-07	Change 98-08	Change 07-08
Total employment	11,570,085	14,018,853	14,469,900	21.2%	25.1%	3.2%
By industry						
Farm employment	281,395	264,519	263,291	-6.0%	-6.4%	-0.5%
Nonfarm employment	11,288,690	13,754,334	14,206,609	21.8%	25.8%	3.3%
Private employment	9,630,230	11,868,442	12,269,508	23.2%	27.4%	3.4%
Forestry, fishing, and related activities	68,875	54,914	56,074	-20.3%	-18.6%	2.1%
Mining	235,864	309,913	358,669	31.4%	52.1%	15.7%
Oil and gas extraction	146,579	163,636	189,877	11.6%	29.5%	16.0%
Mining (except oil and gas)	11,712	13,498	15,401	15.2%	31.5%	14.1%
Support activities for mining	77,573	132,779	153,391	71.2%	97.7%	15.5%
Utilities	48,387	51,370	53,705	6.2%	11.0%	4.5%
Construction	759,931	1,023,614	1,065,791	34.7%	40.2%	4.1%
Manufacturing	1,118,256	991,091	985,013	-11.4%	-11.9%	-0.6%
Durable goods manufacturing	694,745	647,002	642,747	-6.9%	-7.5%	-0.7%
Nonmetallic mineral product manufacturing	42,678	46,171	43,763	8.2%	2.5%	-5.2%
Primary metal manufacturing	29,720	26,712	26,362	-10.1%	-11.3%	-1.3%
Fabricated metal product manufacturing	130,682	136,522	140,530	4.5%	7.5%	2.9%
Machinery manufacturing	84,741	99,050	102,041	16.9%	20.4%	3.0%
Computer and electronic product manufacturing	173,287	113,498	111,609	-34.5%	-35.6%	-1.7%
Nondurable goods manufacturing	423,511	344,089	342,266	-18.8%	-19.2%	-0.5%
Petroleum and coal products manufacturing	24,816	24,869	25,934	0.2%	4.5%	4.3%
Chemical manufacturing	90,321	77,001	78,705	-14.7%	-12.9%	2.2%
Plastics and rubber products manufacturing	53,480	46,998	45,792	-12.1%	-14.4%	-2.6%
Wholesale trade	491,390	569,065	581,681	15.8%	18.4%	2.2%
Retail trade	1,324,927	1,455,617	1,473,120	9.9%	11.2%	1.2%
Transportation and warehousing	428,564	532,140	547,914	24.2%	27.8%	3.0%
Information	271,324	262,717	259,049	-3.2%	-4.5%	-1.4%
Finance and insurance	565,455	724,737	762,376	28.2%	34.8%	5.2%
Real estate and rental and leasing	390,013	563,602	610,746	44.5%	56.6%	8.4%
Professional, scientific, and technical services	631,329	890,142	938,144	41.0%	48.6%	5.4%
Management of companies and enterprises	40,037	83,906	92,787	109.6%	131.8%	10.6%
Administrative and waste services	670,552	941,187	965,770	40.4%	44.0%	2.6%
Educational services	121,392	189,592	197,337	56.2%	62.6%	4.1%
Health care and social assistance	924,422	1,243,612	1,289,772	34.5%	39.5%	3.7%
Arts, entertainment, and recreation	161,283	216,735	225,775	34.4%	40.0%	4.2%
Accommodation and food services	718,376	951,902	978,222	32.5%	36.2%	2.8%
Other services, except public administration	659,853	812,586	827,563	23.1%	25.4%	1.8%
Government and government enterprises	1,658,460	1,885,892	1,937,101	13.7%	16.8%	2.7%
Federal, civilian	184,305	185,411	191,208	0.6%	3.7%	3.1%
Military	165,106	177,541	185,530	7.5%	12.4%	4.5%
State and local	1,309,049	1,522,940	1,560,363	16.3%	19.2%	2.5%

* Only key Texas industries are shown under manufacturing thus lines do not add to total for manufacturing.
Source: Regional Economic Accounts, Bureau of Economic Analysis, U.S. Department of Commerce.

Figure 1. Texas Unemployment versus U.S. (2007-2009)



Source: Local Area Unemployment Statistics, Bureau of Labor Statistics, United States Department of Labor.

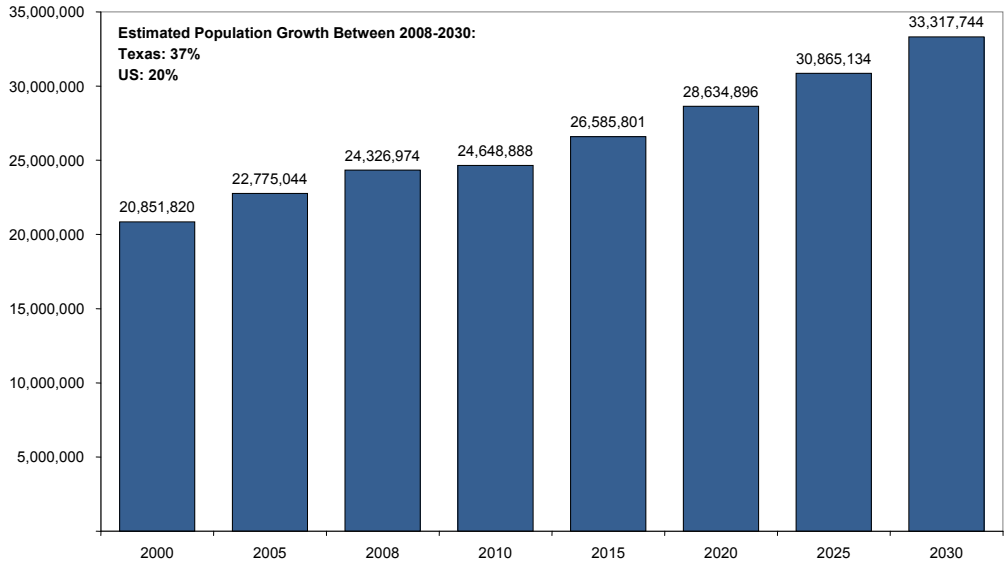
Population Growth in Texas

According to latest Census estimates, the total population of Texas was 24.3 million in 2008, while the total U.S. population was 304 million. The state's population is projected to increase 37 percent between 2008 and 2030, a rate almost twice the national average **(see Figure 2)**. Projections for the U.S. show a 20 percent increase over the same time period.

Real Per Capita GDP in Texas

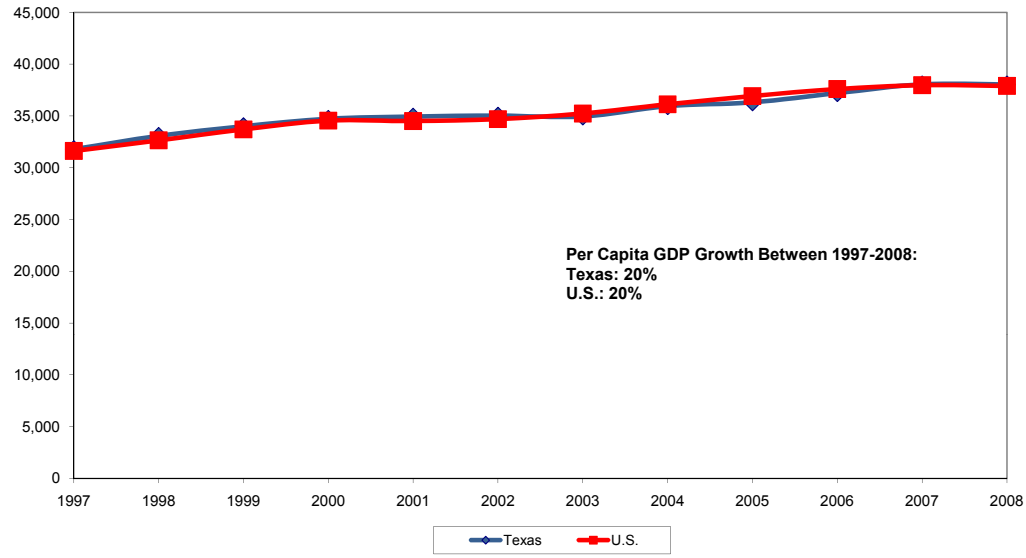
Over the past decade, Texas' real per capita GDP has consistently tracked the U.S. average **(see Figure 3)**. The growth in Texas' real per capita GDP between 1997 and 2008 was identical to U.S. real per capita GDP of 20 percent. In 2008, Texas ranked 19th with $38,044 GDP per person.

Figure 2. Texas Population Projection



Source: State Population Projections, U.S. Census Bureau.

Figure 3. Texas and U.S. Real Per Capita GDP, 1997-2008
(chained 2000 dollars)



Source: Regional Economic Accounts, Bureau of Economic Analysis, U.S. Department of Commerce.

The Texas Energy Sector: Prices, Electricity Generation, and Greenhouse Gas Emissions

Prices

Over the past decade, electricity prices for residential and industrial customers in Texas have tended to be slightly higher than those for the U.S. as a whole. For example, residential electricity prices averaged 9.65 cents per kilowatt hour (kwh) in Texas compared to 9.14 cents/kwh in the U.S. and industrial prices in Texas averaged 5.76 cents/kwh compared to 5.31 cents/kwh in the U.S. from 1997-2008. Over the same period, natural gas prices have tended to be below the U.S. average for all customers (see Table 5).

In 1999, the Public Utility Commission of Texas introduced rules for Renewable Energy Mandates, which established renewable portfolio standards, a renewable-energy credit trading program, and renewable energy purchase requirements for competitive retailers in Texas.[4] In 2005, SB 20[5] updated these energy mandates. The current law requires renewable energy capacity of 5,880 MW by 2015, which represents about 5 percent of the state's electricity demand. According to a report by the Electric Reliability Council of Texas (ERCOT) released in May 2009, Texas already has over 9,400 MW of wind generation installed or committed.

Electricity Generation

Electricity generation in Texas depends mainly on natural gas (47 percent) more than U.S. generation. For the U.S. as a whole, the figure is 23 percent (see Figure 4). Coal is the second dominant energy source (38 percent) in Texas. The state also has significant nuclear generating capacity.

Greenhouse Gas Emissions: Texas and the U.S.

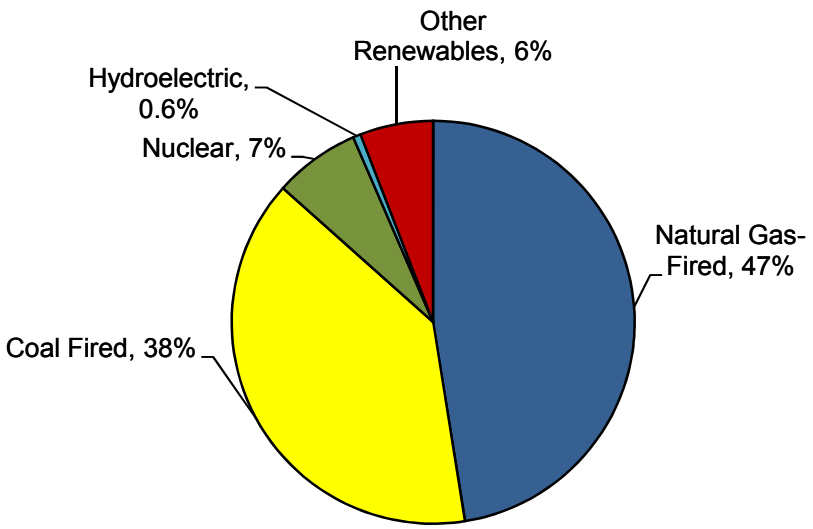
According to a recent Congressional Research Service study, activities in Texas accounted for 782 million metric tons of CO2 equivalent greenhouse gas emissions in 2003.[6] This represents 12 percent of total U.S. GHG emissions in 2003. Approximately 14 percent of Texas' GSP is derived from energy production and energy intensive sectors. In 2003, per capita GHG emission in Texas was 35 tons per person, which is considerably higher than U.S. per capita emissions of 23 tons per person. According to latest Environmental Protection Agency numbers, carbon dioxide emissions in Texas have been following a downward trend since 2004, largely because of declining emissions from the industrial sector due to energy efficiency improvements and an increased share of renewables and nuclear power in electricity production. According to the Agency, fossil fuel related carbon dioxide emissions from all sources declined by 2 percent between 2004 and 2007 in Texas.

Table 5. Energy Prices in Texas and in U.S.

	TX	U.S.	TX	U.S.
	Average (1997-2008)		*Oct-09*	
Electricity (cents/kwh)				
Residential	9.65	9.14	12.26	11.76
Industrial	5.76	5.31	6.58	6.68
Commercial	8.04	8.31	9.69	10.22
Natural Gas ($/thousand cu ft)				
Residential	9.43	9.94	11.97	11.65
Industrial	5.08	5.81	3.99	4.80
Commercial	7.43	8.56	7.51	8.59

Source: Energy Information Administration, Department of Energy.

Figure 4. Net Electricity Generation by Energy Source*



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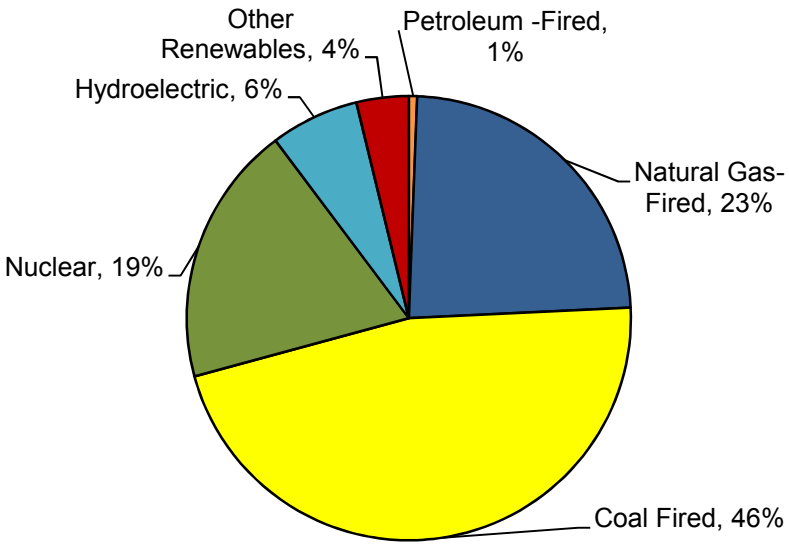

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* Net generation data based on latest available month, October 2009.
Source: Energy Information Administration, Department of Energy

Federal Climate Change Legislation: Potential Economic Impact on Texas

The Waxman-Markey Bill (HR 2454)

The Waxman-Markey bill (HR 2454) passed the U.S. House of Representatives in June 2009. (A similar bill, S. 1733, "The Clean Energy Jobs and American Power Act, was voted out of the Senate Committee on Environment and Public Works on November 5, 2009.) The major differences between Senate and House bills are that the Senate bill requires sharper emission cuts by 2020 than Waxman-Markey, provides fewer carbon allowances to the business sector, allows fewer international offsets, and does not have a renewable portfolio standard (RPS) for utilities. (An RPS bill passed earlier this year out of a Senate Committee.) The American Council for Capital Formation and the National Association of Manufacturers had previously analyzed the economic impact of the Waxman-Markey bill on the U.S. and on all 50 states, including Texas (see analysis at http://www.accf.org/publications/126/accf-nam-study).

The American Clean Energy and Security Act (Waxman-Markey bill), HR 2454, sets targets that would reduce GHG emissions to 17 percent below 2005 levels by 2020, 42 percent below 2005 levels by 2030, and 83 percent below 2005 levels by 2050. In addition, the bill sets targets for renewable energy, carbon capture and storage, low carbon transportation fuels, clean electric vehicles, smart grid, and electricity transmission. By 2020, utilities must use renewable energy and energy efficiency savings to satisfy 20 percent of their total load. The bill also requires increases in energy efficiency across all sectors of the economy. The ACCF-NAM report analyzed the Waxman-Markey bill under low and high cost cases with respect to a baseline that projects the future in the absence of the bill.

Because most of the emission permits to emit a ton of GHGs are given away to industry up until the 2027-2030 time period, the cost of meeting reduction targets is less and the overall economic burden is less than if all permits were auctioned to the highest bidder starting in 2012. After 2027, most permits to emit a ton of carbon will have to be purchased on the open market, thus the economic burden on industry and households becomes much greater.

This analysis was undertaken by ACCF and NAM using NEMS/ACCF-NAM 2,* a version of the National Energy Modeling System (NEMS) model, the model used by the U.S. Energy Information Administration (EIA) for its energy forecasting and policy analysis. In its modeling process, EIA combines the NEMS energy model results with the IHS Global Insight macroeconomic model to quantify the overall economic impacts of policy changes on energy prices, GDP, employment, industry output, etc. The ACCF-NAM analysis employed this same methodology.†

ACCF and NAM applied input assumptions under two scenarios (high-cost and low-cost) investigating the sensitivity of assumptions that have proven in the past to significantly impact the cost of limiting CO2 emissions from energy. The ACCF-NAM input assumptions embody judgment on the likely cost and availability of new technologies in the early decades of a long-term effort to reduce greenhouse gas emissions as well as energy efficiency and renewable electricity standards. These 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, 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.

Based on the ACCF-NAM analysis of the Waxman-Markey bill, the ACCF and the Texas Public Policy Founda-

* The term "NEMS/ACCF-NAM 2" is used in this report to distinguish NEMS runs conducted in this project from NEMS runs conducted by EIA, and from those conducted for ACCF and NAM last year in analyzing the Lieberman-Warner bill (S. 2191).

† For more explanation of the advantages of macroeconomic models for quantifying the impact of energy price changes over other types of economic models see "Climate Change Legislation and U.S. Job Growth: A Review of the Evidence," by Margo Thorning, Ph.D., testimony before the U.S. Committee on Finance (10 Nov. 2009) 3-4, http://www.accf.org/media/dynamic/3/media_395.pdf.

Table 6. Change in Energy Prices at Household Level (% change from baseline)					
Sector	Year	Texas		US	
		Low	High	Low	High
Electricity (Residential)	2020	1.8%	10.2%	5.0%	7.9%
	2025	1.6%	11.8%	4.9%	11.5%
	2030	31.3%	54.1%	31.4%	50.0%
Gasoline	2020	8.6%	11.3%	8.3%	11.1%
	2025	12.2%	16.3%	12.0%	16.0%
	2030	19.5%	25.5%	20.0%	26.1%
Natural Gas (Residential)	2020	-3.2%	0.6%	-3.3%	0.1%
	2025	5.4%	10.6%	4.8%	10.1%
	2030	58.4%	76.8%	56.3%	73.5%

tion have expanded the original two-page report (see report at http://www.accf.org/media/docs/nam/2009/Texas.pdf) on the economic impact on Texas by examining in more detail the effects that major provisions of the bill would have on employment and output in key industrial sectors and on jobs in Texas.

Waxman-Markey's Impact on Energy Prices

Under a cap and trade system for GHG emission reduction, there is risk and uncertainty for business and households (over and above normal market risk) about energy prices due to the unpredictability of the price of a permit to emit a ton of carbon. This uncertainty will increase the cost of capital for new investment and thus tend to retard growth in investment.

Most energy prices would rise under Waxman-Markey, particularly coal, oil, and natural gas. By 2015, gasoline would increase between 6 percent and 9 percent, electricity between 5 percent and 8 percent, and natural gas between 16 percent and 25 percent.

By 2030, gasoline prices increase between 20 percent and 26 percent, while electricity prices increase by up to 54 percent, and natural gas by up to 77 percent. The estimates for natural gas price increases caused by the Waxman-Markey bill include a large increase in U.S. natural gas output, largely due to onshore unconventional gas production. Table 6 shows the increase in energy prices faced by a typical Texas household compared to national household increases over the 2020-2030 period.

Factors Contributing to Higher Electricity Prices

Waxman-Markey would reduce GHG emissions from all sectors of the economy (transportation, residential, commercial, and industry); however, as the largest emitter of GHGs, the primary impact would fall on the electric sector. Waxman-Markey would result in the electric industry shutting down most carbon-based generation and/or using expensive, as yet unproven technology, to capture and store CO2. To meet the stringent goals of Waxman-Markey, the electric industry would also have to substitute high-cost technologies, such as biomass and wind, for conventional generation (see Figure 5 for decrease in Texas coal production over the 2020-2030 period).

The refining sector would experience a significant impact from Waxman-Markey because it is held responsible for 44 percent of emissions under the bill. These include the refinery's own emissions (about 4 percent) as well as consumer emissions from planes, trains, automobiles, heating oil, and other petroleum use. Since refiners are allocated only 2.25 percent of the allowances under the bill, they would be disadvantaged compared to industries which received free allowances that match or exceed their obligation.

Per capita emissions would have to drop significantly for the U.S. as whole. Per capita emissions would have to be reduced from 17 tons under the baseline forecast to 9 tons in 2030 (see Figure 6).

Figure 5. Change in Texas Production by Sector: Coal (percent)

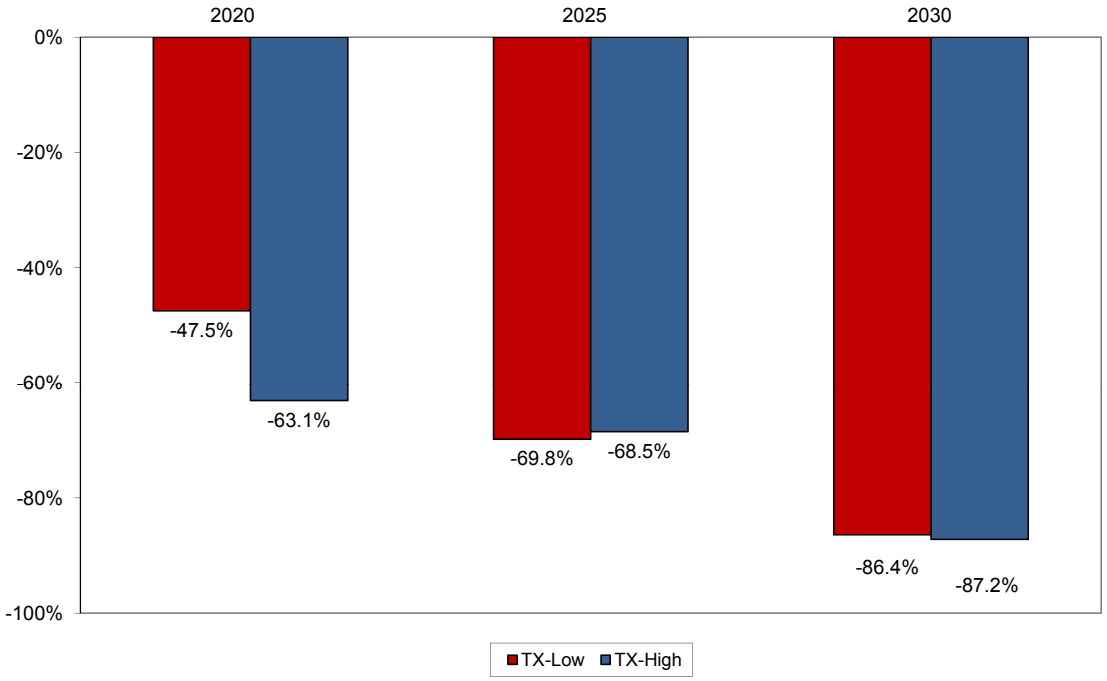
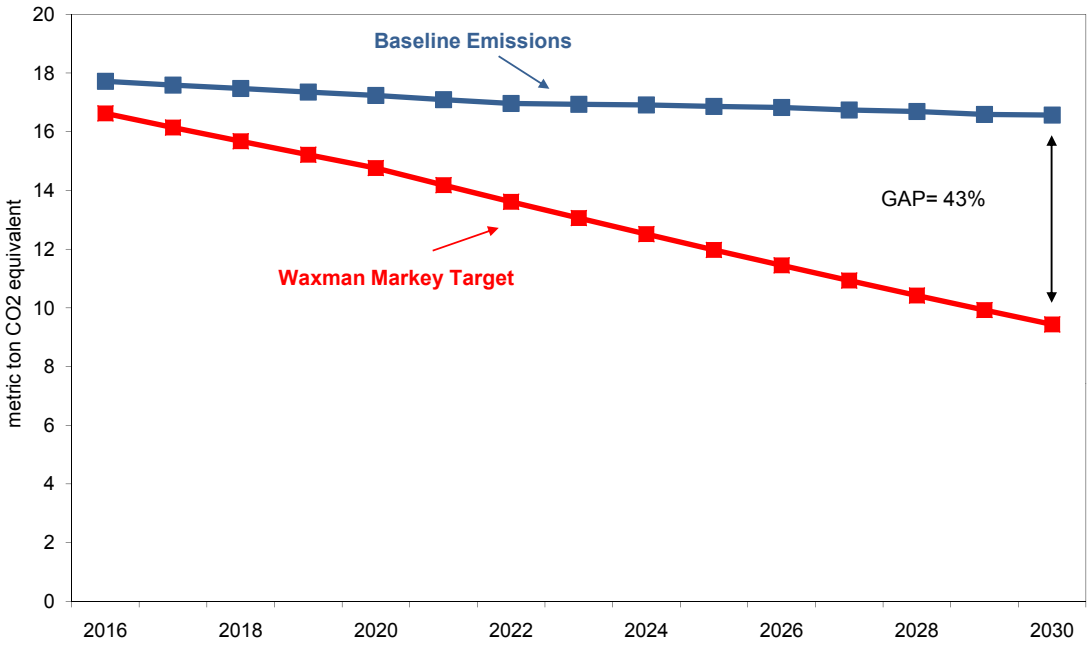


Figure 6. Macroeconomic Impact of Waxman-Markey Bill: Per Capita Energy Sector CO2 Emissions in U.S.



Impact on Industrial Output

Texas' major economic sectors will be affected by emission caps **(see Figure 7)**. The current two largest sectors, chemical manufacturing and computer and electronic product manufacturing, show decreases in output of 12.9 percent to 13.9 percent and 4.9 percent to 5.9 percent, respectively, in 2030. All manufacturing sectors will suffer output losses of between 4.6 percent and 5.4 percent by 2030, while output from energy intensive sectors fall between 11.0 percent and 11.8 percent **(see Figure 8)**. Projections from ERCOT show that, in the absence of additional measures to control GHGs, Texas will need approximately 14 percent more electricity by 2020. However, as a result of the Waxman-Markey bill's impact on energy prices which reduces demand for electricity, Texas' electricity production falls by 5.9 percent to 8.7 percent in 2020 and by 11.7 percent to 17.8 percent in 2030. As mentioned above, coal production declines by 86 percent to 87 percent by 2030. These continued losses will have a lasting effect on the economic base of Texas.

Figure 7. Change in Texas Output by Major Industry in 2030 (percent)

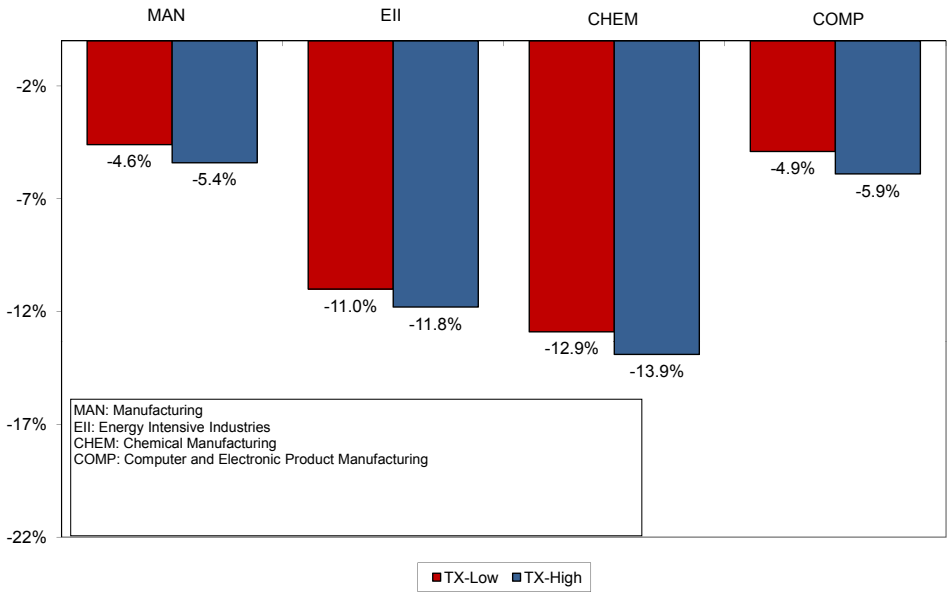


Figure 8. Change in Texas Electricity Production (percent)

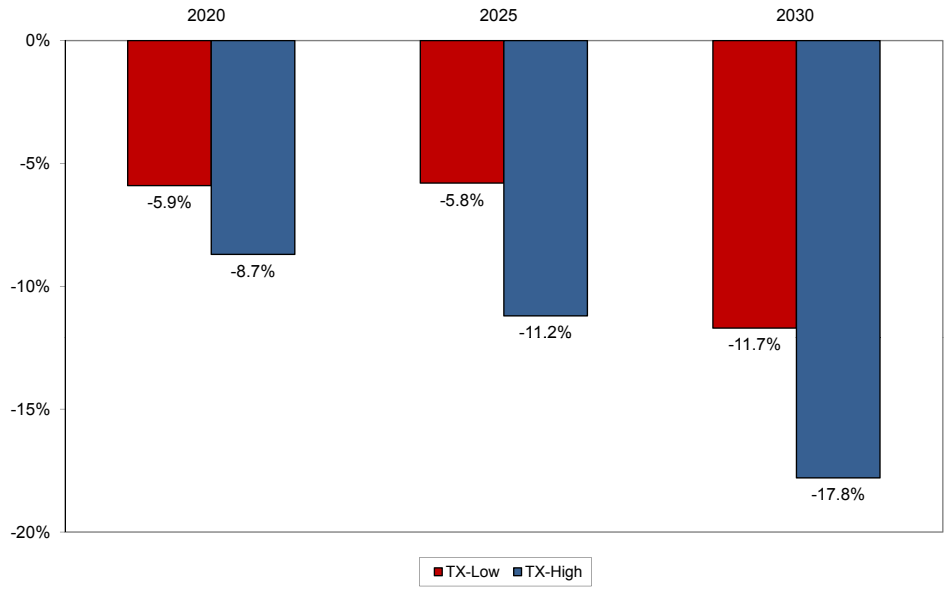


Table 7. Change in Texas Output by Major Manufacturing Sector Relative to Baseline (Percent)				
	Low Cost Case		High Cost Case	
	2020	2030	2020	2030
Manufacturing	-3.5%	-4.6%	-3.7%	-5.4%
Wood product manufacturing	-4.3%	-6.9%	-4.5%	-7.6%
Fabricated metal product manufacturing	-3.7%	-5.8%	-3.9%	-6.9%
Machinery manufacturing	-6.6%	-7.1%	-7.0%	-8.7%
Computer and electronic product manufacturing	-3.6%	-4.9%	-3.8%	-5.9%
Electrical equipment and appliance manufacturing	-4.7%	-5.7%	-5.0%	-7.0%
Motor vehicle, body, trailer, and parts manufacturing	-4.8%	-7.5%	-5.0%	-8.0%
Furniture and related product manufacturing	-2.7%	-5.6%	-2.8%	-6.2%
Miscellaneous manufacturing	0.0%	-0.5%	0.0%	-0.3%
Food product manufacturing	-1.8%	-1.9%	-1.9%	-2.2%
Textile and textile product mills	-3.5%	-4.9%	-3.7%	-5.5%
Apparel manufacturing	-6.2%	-7.5%	-6.7%	-8.7%
Printing and related support activities	-0.3%	-1.0%	-0.3%	-1.1%
Energy Intensive Manufacturing	-6.7%	-11.0%	-7.0%	-11.8%
Nonmetallic mineral product manufacturing	-10.4%	-17.8%	-10.9%	-19.2%
Primary metal manufacturing	-13.4%	-22.8%	-14.2%	-25.5%
Paper manufacturing	-3.9%	-6.6%	-4.1%	-7.2%
Petroleum and coal products manufacturing	-4.7%	-7.5%	-4.8%	-7.8%
Chemical manufacturing	-7.8%	-12.9%	-8.2%	-13.9%
Plastics and rubber products manufacturing	-5.9%	-10.8%	-6.2%	-11.7%

As shown in Table 7, while all major manufacturing sectors in Texas decline under Waxman-Markey, certain energy-intensive sectors like primary metal manufacturing and nonmetallic mineral product manufacturing tend to be especially hard hit. Output in these industries declines by as much as 19 percent to 26 percent by 2030 compared to the baseline forecast.

The results of the ACCF-NAM simulations with the NEMS model project the likely economic effects of the higher energy prices that would occur under the Waxman-Markey bill. A real world example of the effect that increased energy prices have on U.S. industry and employment can be observed by examining trends in the U.S. chemical industry. For example, chlorine is an essential chemical building block used in the production of pharmaceuticals, medical devices, safety equipment, computers, automobiles, aircraft parts, and crop protection chemicals. Chlorine production in based on electro-chemistry and is one of the most energy-intensive production processes. In recent years, U.S. chlorine capacity has been shut down because of record high electricity costs arising from high natural gas prices, according to the American Chemistry Council. In addition, a report by SRI Consulting indicates that ammonia capacity fell from 14.8 million tons in 1999 to 13.6 million tons in 2007, an 8 percent reduction. Data on global natural gas prices for the third quarter of 2008 show that U.S. producers faced much higher prices than many other countries. Thus it is not surprising that much chemical production has migrated to lower cost locations.

Similarly, nitrogenous fertilizers play a major role in boosting crop yields and ammonia is the key raw material for these fertilizers. Ammonia production has also been affected by sharply rising natural gas prices. According to The Fertilizer Institute, from 1999-2007, 25 ammonia plants have been closed and a report by SRI Consulting indicates that ammonia capacity fell from 15.5 million metric tons in 1999 to 9.8 million metric tons in 2003, a 37 percent reduction. Approximately 120,000 jobs have been lost in the U.S. chemical industry since 1999, when natural gas prices began their sharp rise, according to the American Chemistry Council.

Impact on Employment in Texas

The jobs impact of Waxman-Markey is delayed by the free allocation of permits and generous carbon offsets. In 2030, as emission reduction targets tighten and other Waxman-Markey provisions phase out, Texas jobs decline by 144,597 under the low cost case and by 196,928 under the high cost case relative to the baseline forecast (see Figure 9). The primary cause of job losses is lower industrial output due to higher energy prices, the high cost of complying with required emissions cuts, and greater competition from overseas manufacturers with lower energy costs. Table 8 shows the projected job losses by sector. Chemical manufac-

Figure 9. Loss in Employment in Texas

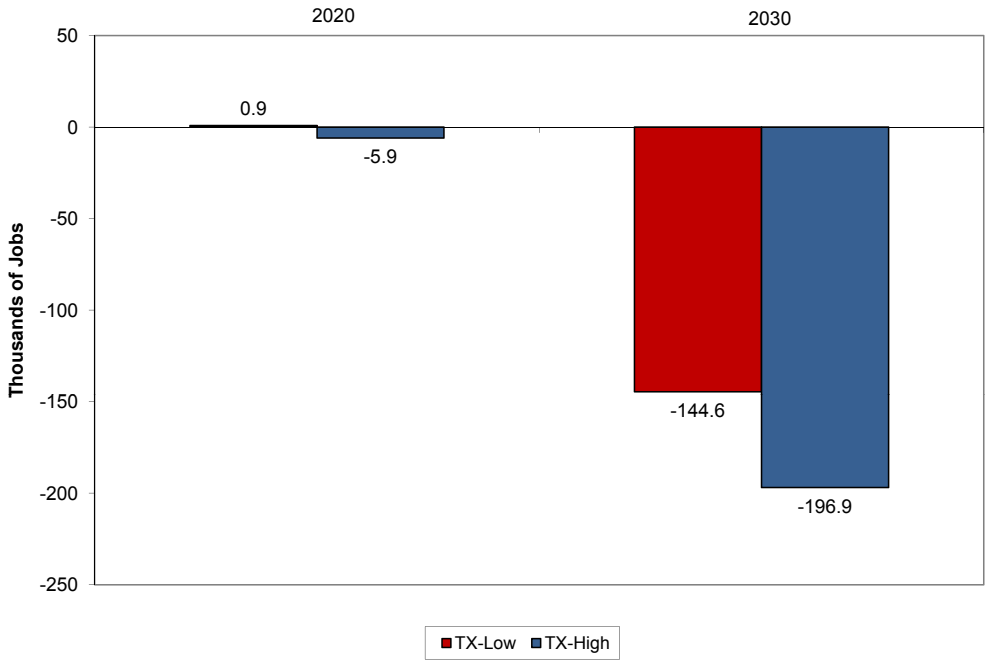
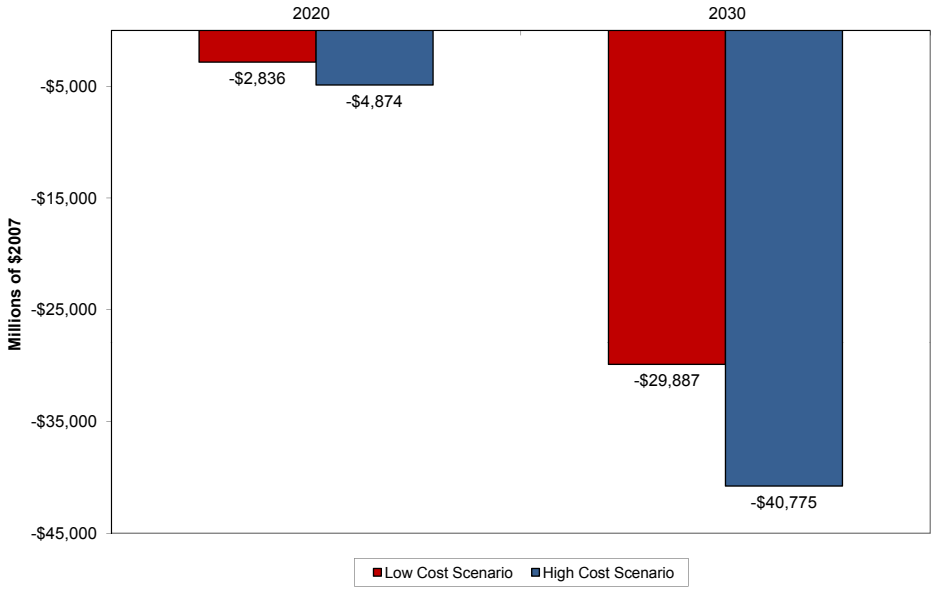


Table 8. Change in Texas Employment by Major Manufacturing Sector Relative to Baseline				
	Low Cost Case		High Cost Case	
	2020	2030	2020	2030
Total Employment Change in All Sectors	853	-144,597	-5,932	-196,928
Major Manufacturing Sectors				
Wood product manufacturing	-1,197	-2,110	-1,269	-2,301
Fabricated metal product manufacturing	-4,333	-7,470	-4,585	-8,928
Machinery manufacturing	-5,641	-6,568	-5,969	-8,058
Computer and electronic product manufacturing	-3,768	-5,663	-3,984	-6,743
Electrical equipment and appliance manufacturing	-883	-1,177	-939	-1,437
Motor vehicle, body, trailer, and parts manufacturing	-1,501	-2,555	-1,588	-2,752
Furniture and related product manufacturing	-854	-1,898	-883	-2,084
Miscellaneous manufacturing	-9	-211	6	-115
Food product manufacturing	-1,609	-1,881	-1,730	-2,114
Textile and textile product mills	-373	-579	-398	-645
Apparel manufacturing	-632	-823	-685	-956
Printing and related support activities	-107	-388	-108	-426
Total	*-20,908*	*-31,324*	*-22,132*	*-36,560*
Energy Intensive Manufacturing				
Nonmetallic mineral product manufacturing	-4,372	-8,091	-4,593	-8,751
Primary metal manufacturing	-3,249	-5,972	-3,438	-6,675
Paper manufacturing	-758	-1,400	-796	-1,528
Petroleum and coal products manufacturing	-1,066	-1,842	-1,091	-1,900
Chemical manufacturing	-5,557	-9,982	-5,849	-10,767
Plastics and rubber products manufacturing	-2,606	-5,122	-2,738	-5,581
Total	*-15,002*	*-27,287*	*-15,766*	*-29,620*

Figure 10. Loss in Gross State Product in Texas



turing and fabricated metal product manufacturing suffer the largest job losses. (Job loss projections in Table 8 were based on the output losses from the earlier ACCF-NAM analysis so they are approximations rather than precise estimates.)

Even though Waxman-Markey will create new "green" jobs due to the shift toward less carbon-intensive fuels, more renewable energy, and increased expenditures for energy efficiency across all sectors of the economy, the overall result will be fewer jobs than under the baseline forecast. Since electricity produced by wind and solar power has to be backed up with conventional generating capacity, the impact of the Waxman-Markey bill is to force the substitution of more expensive energy for cheaper fossil fuel energy. As a result, growth in productivity, GDP and employment is slowed.

Impact on Economic Growth

High energy prices, fewer jobs, and loss of industrial output are estimated to reduce Texas' GSP by between $2.8 billion and $4.9 billion per year by 2020, and $29.9 billion and $40.8 billion by 2030 **(see Figure 10)**.

Impact on Disposable Income

Higher energy prices would have ripple impacts on prices throughout the economy and would impose a financial cost on households. Texas would see disposable household income reduced by $86 to $216 per year by 2020, and $612 to $1,103 by 2030 **(see Figure 11)**.

Impact on Low-Income Families

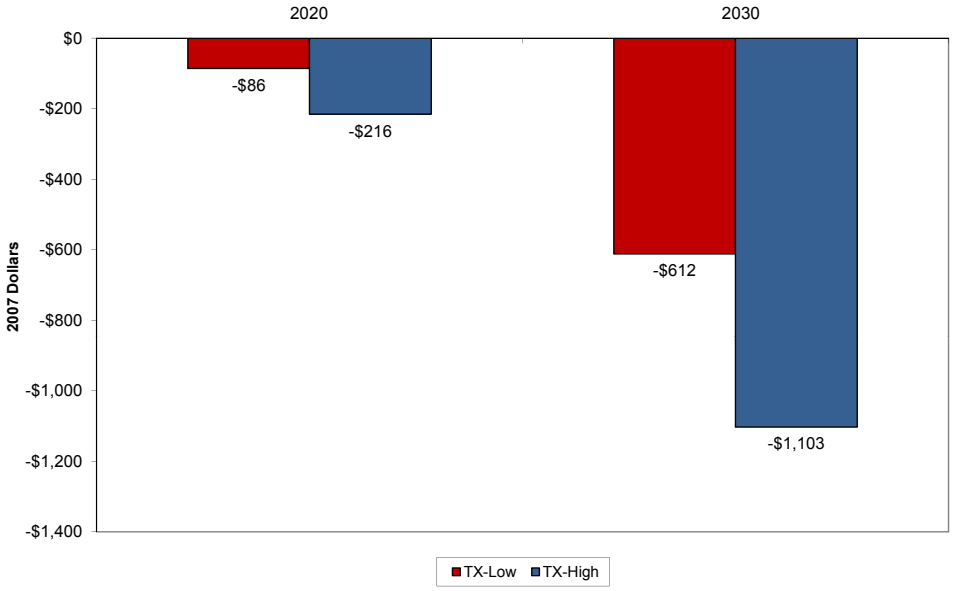
The impacts of Waxman-Markey will be felt especially by the poor, who spend a greater share of their income on energy and other goods than other income brackets. By 2030, higher energy prices mean that low-income families in Texas (with average incomes of $14,505) will spend between 19.9 percent and 21.0 percent of their income on energy under Waxman-Markey compared to a projected 17.7 percent without Waxman-Markey. Others on fixed incomes such as the elderly will also suffer disproportionately.

Impact on State Budgets

The increases in Texas' energy costs under Waxman-Markey will impact expenditures throughout the state. Specifically, Texas' 10,337 schools and universities and 622 hospitals will likely experience a 20.3 percent to 30.6 percent increase in energy expenditures by 2030. For government entities, costs for services, including public transportation and vehicle fleets, such as school buses, will also rise under Waxman-Markey.

In 2008, Texas' total net revenue was $85.634 billion which was approximately 7 percent of state GSP.[7] Using the same ratio, if GSP declines by between $30 billion and $41 bil-

Figure 11. Loss of Disposable Income per Household in Texas



lion in 2030, state tax revenues will decline by about $2.1 billion to $2.87 billion that year. Such budgetary shortfalls could force hard choices on Texas policymakers.

Conclusions

Texas has fared relatively better in the current recession compared to other states. Its economic and job growth has surpassed that of the U.S. for the past decade and its budget surplus puts it in a more favorable position than most other states. If climate policy bills like Waxman-Markey (HR 2454) or Kerry-Boxer (S.1733) are enacted, economic recovery from the current recession will be impeded as business and households face rising energy prices. In the longer term, Texas' real GDP, employment, industrial output, state budget revenues, and household income will fall relative to the baseline forecast. Although historically an economic driver—and with a recent resurgence—the energy production and manufacturing sectors of Texas are particularly vulnerable to significant impacts from federal policies mandating GHG reductions. As state policymakers consider legislation to reduce U.S. GHG emissions, they need to consider that the cost of reducing emissions is likely to exert significant drag on the state's economy. ✯

Endnotes

1 "Fueling the Texas Economy," Texas Oil and Gas Association, March 2009.

2 U.S. Energy Information Administration, http://tonto.eia.doe.gov/energyexplained/index.cfm?page=us_energy_industry#tab2.

3 American Chemistry Council, http://www.americanchemistry.com/s_acc/sec_impact_states.asp?CID=798&DID=3367.

4 Texas Incentives/Policies for Renewables & Efficiency, Database of State Incentives for Renewables and Efficiency, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=TX03R&state=TX&CurrentPageID=1.

5 http://www.capitol.state.tx.us/tlodocs/791/billtext/pdf/SB00020F.pdf.

6 "State Greenhouse Gas Emissions: Comparison and Analysis," CRS Report for Congress (5 Dec. 2007) 3.

7 *Texas Fact Book*, http://www.lbb.state.tx.us/Fact_Book/Texas_FactBook_2010.pdf.

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