Economic Impacts of Proposed House/Senate Energy Legislation on the U.S. Economy

Prepared By:

CRA International

1201 F Street, N.W., Suite 700

Washington, D.C. 20004

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1. EXECUTIVE SUMMARY

CRA International has used its state-of-the-art MRN-NEEM modeling system to analyze the potential economic impacts of energy legislation currently being considered by the U.S. Congress. The analysis assesses how the legislation would affect key performance metrics of the United States' economy.

It examined the following current provisions in the congressional bills: a mandatory oil savings program, a renewable fuels standard (RFS), oil industry tax increases, a "price gouging" provision, a renewable portfolio standard (RPS) for the electric power sector, more stringent CAFE standards, and various proposed access restrictions on domestic production of oil and natural gas. Optimistic assumptions regarding the costs of the proposed provisions were assumed in this report. By inference, the estimated economic impacts reported herein should be considered conservative.

The report finds that the proposed energy legislation would have significant adverse impacts on the U.S. economy.

IMPACTS ON SPECIFIC METRICS OF ECONOMIC PERFORMANCE

Specific impacts of the legislation on economic performance include the following:

- Additional taxes on the oil and natural gas industry combined with additional restrictions on drilling could result in an estimated average decline in domestic oil production of roughly 4% over the 2010–2020 period, and an estimated average decline in domestic natural gas production of 2% relative to baseline levels.

- The proposed legislation is projected to result in significantly higher costs across a wide array of goods and services, especially for transportation fuels. As a result, the demand for petroleum products is estimated to decline by roughly 18 percent in 2020 and by one-third in 2030 relative to baseline levels. Overall, U.S. transportation fuel consumption is projected to decline due to significantly higher costs faced by end-users.

- By 2030, the proposed legislation is projected to cause a net loss of roughly 4.9 million total jobs from baseline levels. While all regions of the country would be adversely impacted, the Southeast, areas around the Great Lakes, and Texas-Oklahoma regions would be disproportionately affected.

- By that year, the proposed legislation is estimated to diminish the average American household's annual purchasing power by approximately $1,700.

- Aggregate investment is projected to fall by 3.4% from baseline levels by 2030. As with the employment losses, the impact would be uneven both across industries and among regions. The pattern resembles that of estimated employment losses.

- By 2020, GDP, a commonly used measure of total economic activity, is estimated to be roughly 1.7% below the baseline and by 2030 is estimated to drop to approximately 4.0% below baseline levels. Petroleum refining, commercial transportation services, motor vehicles, electric generation and energy intensive manufacturing would be among the disproportionately affected sectors.

The proposed legislation would restrict the supply of energy available to the U.S. economy and would likely increase energy costs. Higher energy costs would likely reduce total consumption, employment, investment, and economic output. The link between energy supply and the economic performance is key to understanding the pattern of the study results and central to an assessment of the implications of the proposed legislation.

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2. RESULTS

CRA International has analyzed the potential economic impacts of energy legislation currently being considered by the U.S. Congress. The goal of this analysis was to assess how this legislation would affect key performance metrics of the United States' economy. This section summarizes the results of that assessment. The report finds that the proposed energy legislation would have significant adverse impacts on the U.S. economy. Key findings in 2030 include estimated job losses approaching 5 million, a projected reduction in GDP of 4% and an estimated loss in average household real income of about $1,700 per household.

CRA assessed not only the national impacts of the proposed legislation, but also evaluated the regional differences in the legislation's prospective effects. This was possible through CRA's use of its MRN-NEEM model, which incorporates substantial amounts of detail about the regional components of America's economy. The long term nature of the model allows the analysis to reach far enough into the future to capture the longer term effects of this legislation, some provisions of which would not take full effect until 2030. The key variables in the MRN-NEEM model such as energy usage, energy production, and overall economic activity are calibrated in the baseline to closely track official government forecasts.

2.1. KEY PROVISIONS

This legislation is still under discussion, and its final form remains uncertain. This analysis will describe the cumulative economic consequences likely to follow from enactment of *seven of the major legislative provisions contained in either the House or the Senate versions of the bill*. The analysis does not attempt a detailed evaluation of every provision of the House and Senate energy bills. Instead it attempts to capture the combined impacts on the national economy of the major provisions of the two bills

Because these provisions require commercialization of unproven technologies, imposition of mandates, the costs of which are uncertain, and due to uncertainty surrounding the legislation itself, this report adopts optimistic assumptions regarding costs and technologies so as to be able to report conservative estimates of economic impacts.

The seven key provisions, which are described in greater detail in the report's next section, are:

1. OIL SAVINGS PROGRAM: The Senate bill would require a mandatory national "oil savings" program to reduce oil use by 10 million barrels per day (MBD) by 2031. The provision would specify cuts of 2.5 MBD by 2016, and 7 MBD by 2026 but would not stipulate the means by which these reductions would be achieved. (Sec. 251)

2. RENEWABLE FUELS STANDARD (RFS): This Senate provision would mandate renewable fuel use of 36 billion gallons by 2022. (Sec. 111) It would also mandate use of 21 billion gallons of advanced biofuels by 2022 and would specify incremental

increases in the years preceding these target dates. (Sec. 111) This report assumes that cellulosic ethanol would be commercially available in the required volumes for the specified target dates as mandated by this provision, even though this is highly uncertain. No large-scale commercial cellulosic ethanol plants currently exist. The economic impacts of the mandate are likely to be larger to the extent that biofuels production falls short of mandated targets.

3. TAX PROVISIONS: The House bill would raise oil industry taxes by over $15 billion over a 10 year period. (Sec. 13011, 13012, 13013) The tax provisions were assessed in this analysis over a ten year period from 2010 to 2020; the time period for which official tax revenue estimates from the Joint Committee on Taxation were available. In actuality, the proposed legislation does not call for these provisions to sunset after 10 years. By inference, the estimated economic impacts on the oil and gas industry are likely understated in this report.

4. PRICE GOUGING: The Senate bill would prohibit gasoline "price gouging" during presidentially declared emergencies and would establish civil and criminal penalties for violators. (Sec. 603) The House passed a separate, stand-alone price gouging bill earlier this year.

5. RENEWABLE PORTFOLIO STANDARD (RPS): The House bill would require investor owned utilities to provide 15 percent of their power from renewable sources by 2020. (Sec. 9611)

6. CORPORATE AVERAGE FUEL ECONOMY (CAFE) STANDARDS: The Senate bill would mandate increased CAFE standards to achieve a combined 35 miles per gallon average for passenger cars and light trucks by 2020. For model years 2021 through 2031, the Department of Transportation (DOT) would have to establish the "maximum feasible" standard for the fleet. (Sec. 502)

7. PROVISIONS RESTRICTING ACCESS: The House Bill would impose additional fees and royalty payments on oil and natural gas leases in the Gulf of Mexico and would impose new restrictions on drilling for oil and natural gas on federal lands. (Sec. 7101-7106)

2.2. RESULTS

The projected combined effect of these legislative provisions would be to simultaneously decrease the supply and increase the costs of energy supplies to the U.S. economy. These changes would be expected to reverberate through the economy and would likely increase energy costs and decrease production and consumption across a wide array of goods and services. The size of the projected impacts varies by region but the direction does not. The projected impacts would increase with time with the largest changes projected to occur after 2020.

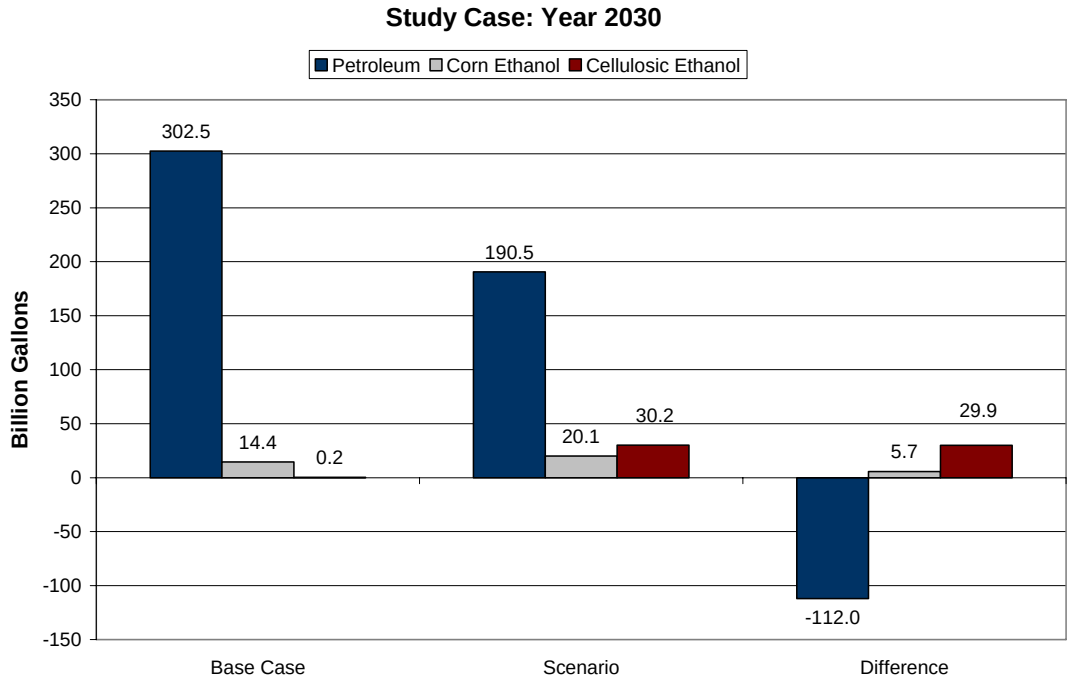
2.2.1. Energy market impacts

This legislation would likely raise energy costs. The bills' impact on energy costs is the result of the provisions that would both restrict fuel supplies and the mandates that would require substitution of higher cost renewables for less costly conventional fuels. The mandated reduction in petroleum use would directly reduce the quantity of energy available to the U.S. economy, and new proposed restrictions on domestic oil and natural gas production would amplify this effect. Higher taxes and fees on oil and natural gas would also discourage production and raise cost.

Aggressive increases in the renewable fuels standard (RFS) and adoption of a renewable portfolio standard (RPS) would both require substitution of higher cost renewable energy for conventional fuels. This substitution would likely lead to higher energy costs in the transportation and electricity sectors respectively.

The projected impacts on the market for transportation fuels are especially pronounced. Figure 2-1 illustrates the pattern and the scale of the distortions.

Figure 2-1: Projected Impact on Transportation Fuels Consumed Due to Proposed House/Senate Energy Legislation



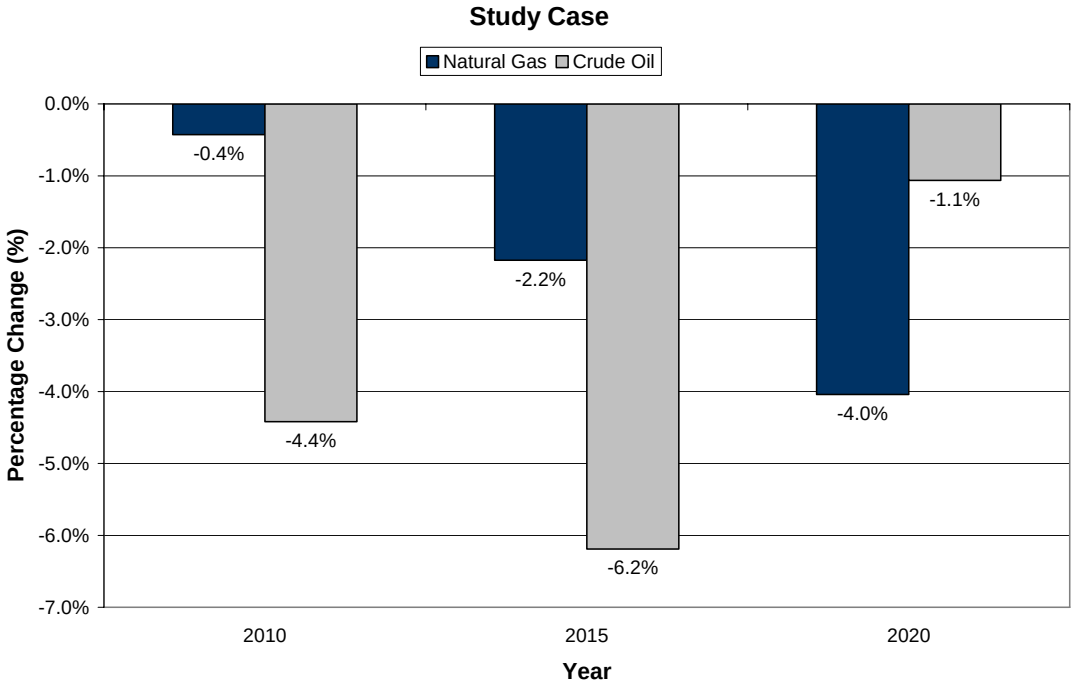
As the figure shows, it is estimated that the provisions would drive down the demand for petroleum products by roughly one-third in 2030. The renewable fuels standard is estimated to increase corn-based ethanol use by almost 40 percent, and cellulosic ethanol is estimated to reach almost 13 percent of the total market. This projected change would result from the

provision's proposed requirements that at least 60% of biofuels be advanced biofuels by 2022.

Overall, U.S. transportation fuel consumption would decline due to higher costs faced by end-users. Costs of petroleum products to end-users are estimated to rise significantly over the baseline levels to effect the above illustrated shifts in transportation fuel volumes. Other energy markets would also be affected although less than that for transportation fuels.

Proposed additional taxes on the oil and natural gas industry of $15 billion over 10 years combined with restriction on drilling collectively would add to the cost of finding and producing oil and natural gas from our domestic resource base and would result in less domestic production as seen in Figure 2-2.

Figure 2-2: Projected Impact on Domestic Oil and Natural Gas Production Due to Proposed House/Senate Energy Legislation

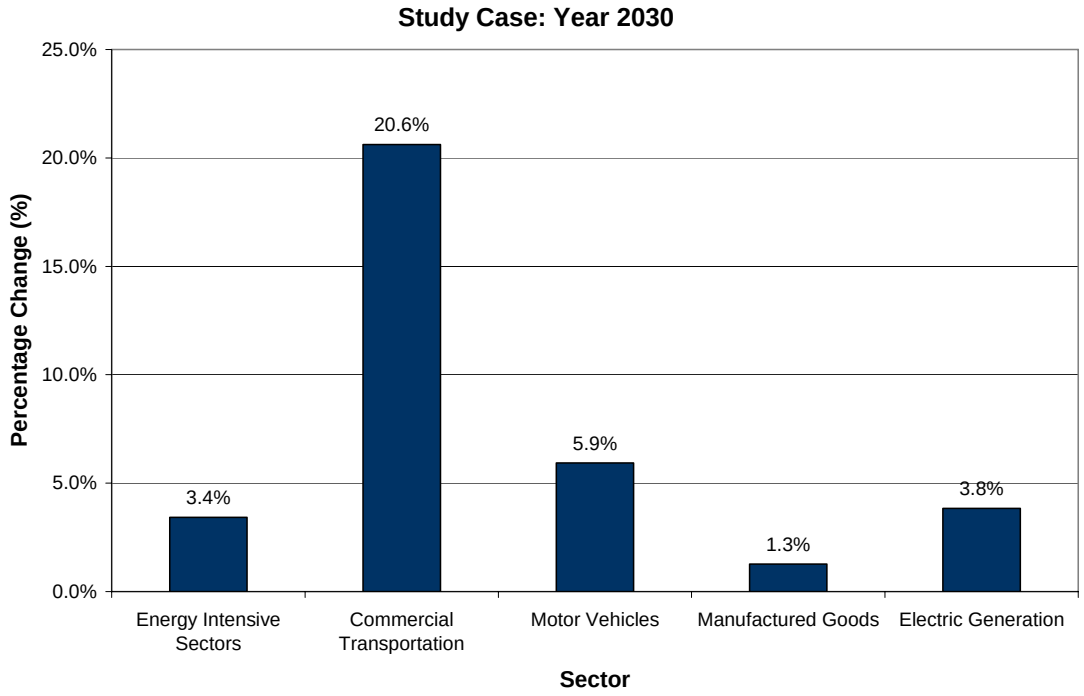


As indicated earlier in the report, the above estimated production impacts on crude oil and natural gas are likely conservative due to the assumption in this analysis that the taxes would sunset after 10 years. In actuality, they would continue under the proposed legislation.

Higher costs paid by end-users would not be limited solely to refined petroleum products. The provisions in these bills are estimated to not only increase energy costs, but would likely create a ripple effect throughout the economy as energy is an input to producing goods and services in other sectors of the economy. As a result, end-users would likely face higher costs for these other goods and services that they consume on a daily basis as shown in

Figure 2-3. The costs are estimated to increase over time as the oil reduction program requires further cuts in oil consumption. Commercial transportation is estimated to experience the largest increase in costs as transportation fuels are a significant component of this sector's operating costs. Costs for motor vehicles would also be significantly affected as manufacturers would likely comply with higher CAFE standards by manufacturing more expensive vehicles. The cost of electricity to end-users is also estimated to rise to due the RPS provision as would the cost of energy intensive manufactured goods.

Figure 2-3: Projected Impact on End-User Costs of Goods and Services Due to Proposed House/Senate Energy Legislation



2.2.2. Non-Farm employment impacts

Higher energy costs would likely cause decreases in the quantities of goods and services produced by the economy. As the expected costs of energy services climb, the productivity of capital and labor tend to fall. Business activity is likely to contract relative to the levels that would have prevailed without policy-induced energy cost hikes. The demand for labor would weaken, and employment would decline, again, relative to that which would have prevailed without the higher energy costs. Figure 2-4 illustrates that from 2010, when the proposed legislation's impact is negligible, until 2020, when many proposed provisions would have taken effect fully or in part, job loss is projected to increase to more than 2 million below the baseline level. By the year 2025, non-farm job loss is estimated to increase to about 3.5 million, and would continue to decline to almost 5 million below the baseline level by the year 2030.

Figure 2-4: Projected Changes to Non-Farm Employment Due to Proposed House/Senate Energy Legislation

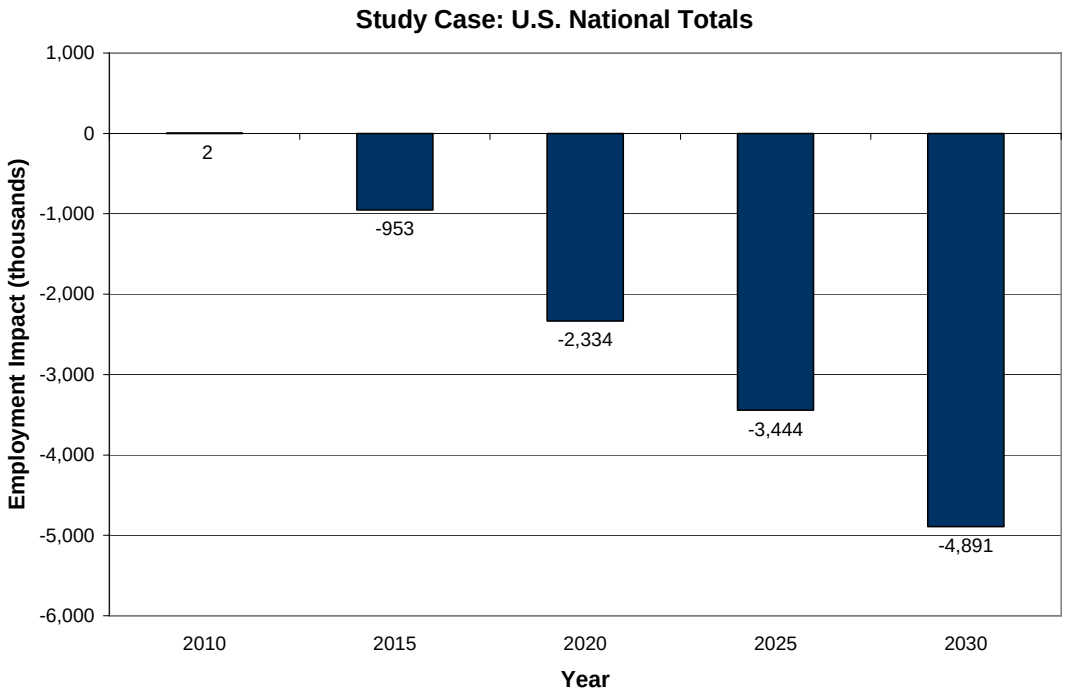
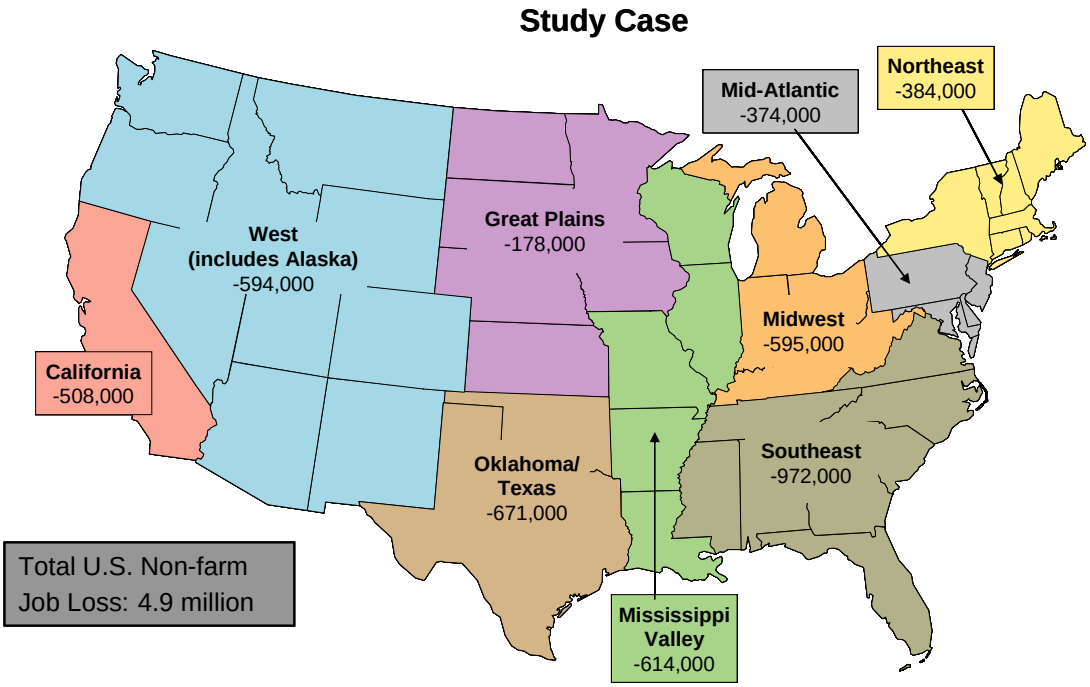


Figure 2-5 indicates that the job losses expected from the bills, although pervasive, would be distributed unevenly. Some industries are more energy intensive than others. In some cases, like commercial transportation, energy intensive activities are geographically widely dispersed. In other instances, like energy intensive manufacturing and petroleum refining/petrochemical production, activities are more geographically concentrated. The Mississippi Valley, the Midwest, Texas and Oklahoma and the Southeast are important centers for these industries. The model results indicate that these regions would be disproportionately affected though all regions would be adversely impacted.

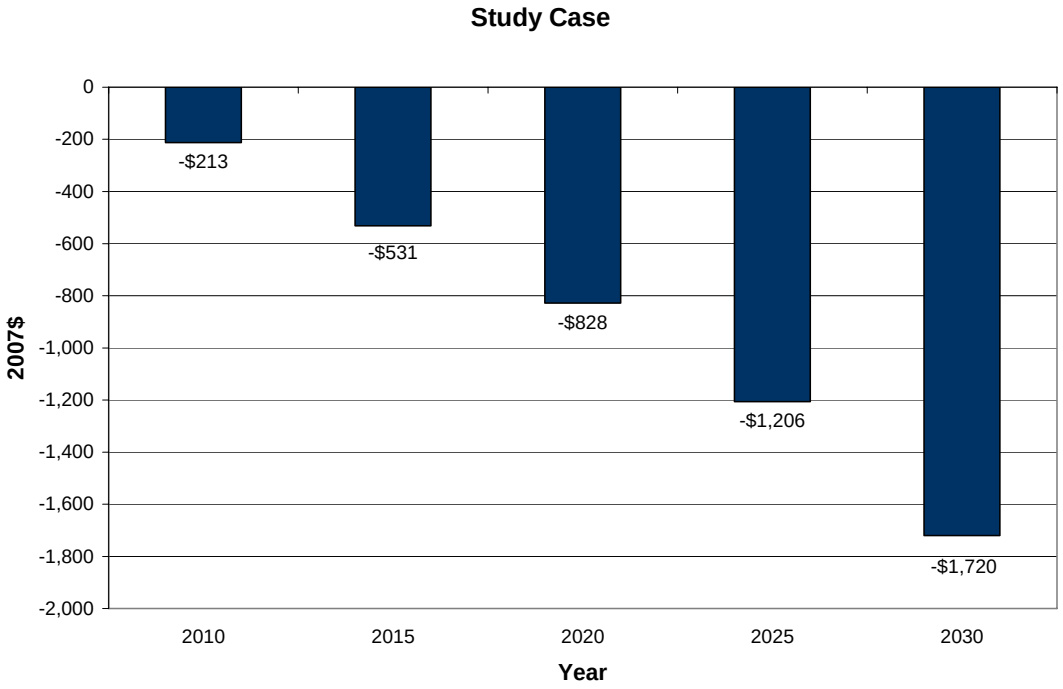
Figure 2-5: Projected Regional Distribution of Changes to Non-Farm Employment Due to Proposed House/Senate Energy Legislation



2.2.3. Impacts on household consumption

Higher energy costs generally mean that consumers must spend a larger percentage of their income to maintain their current level of household energy services. At the same time, significant quantities of energy are needed to produce and transport the many non-energy goods and services. The projected higher costs of these goods and services would be expected to magnify the loss in household purchasing power associated with the direct purchase of energy services. Figure 2-6 estimates the increasing erosion of household consumption that the legislation would likely cause.

Figure 2-6: Projected Impact on Household Purchasing Power Due to Proposed House/Senate Energy Legislation

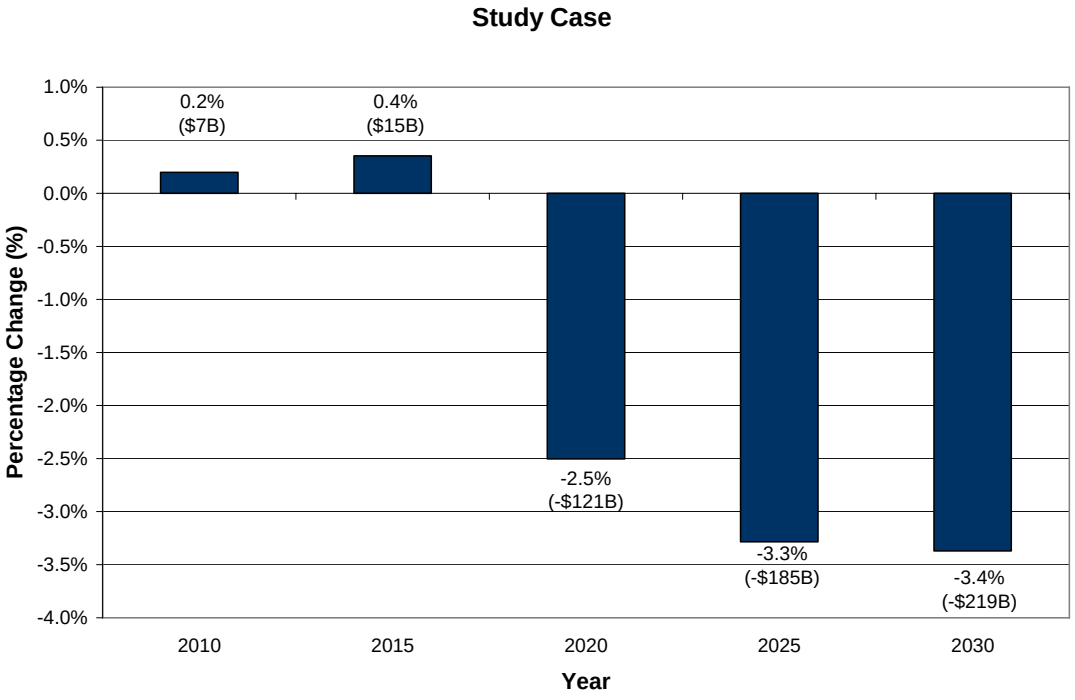


The figure reveals the expected pattern of increasing losses through time. In 2020, the average household is estimated to experience a loss in purchasing power of roughly $830 relative to the baseline level, and by 2030, the average household's purchasing power is projected to decline by roughly $1,700, again, relative to the baseline level.

2.2.4. Aggregate investment

As household and business consumption fall, the demand for goods and services also tends to weaken; moreover, higher energy costs place upward pressure on manufacturing costs. In combination these factors mean that fewer investments would be able to meet a profitability test, and they would dampen demand for such investments. Figure 2-7 indicates that in the early years, there is an estimated small increase in investment above baseline levels. This result occurs because some investment is shifted forward to the early years when the provisions are less restrictive and hence returns on investment are higher, and also because of increased investment associated with the various mandates in the legislation.

Figure 2-7: Projected Impact on Aggregate U.S. Investment Due to Proposed House/Senate Energy Legislation

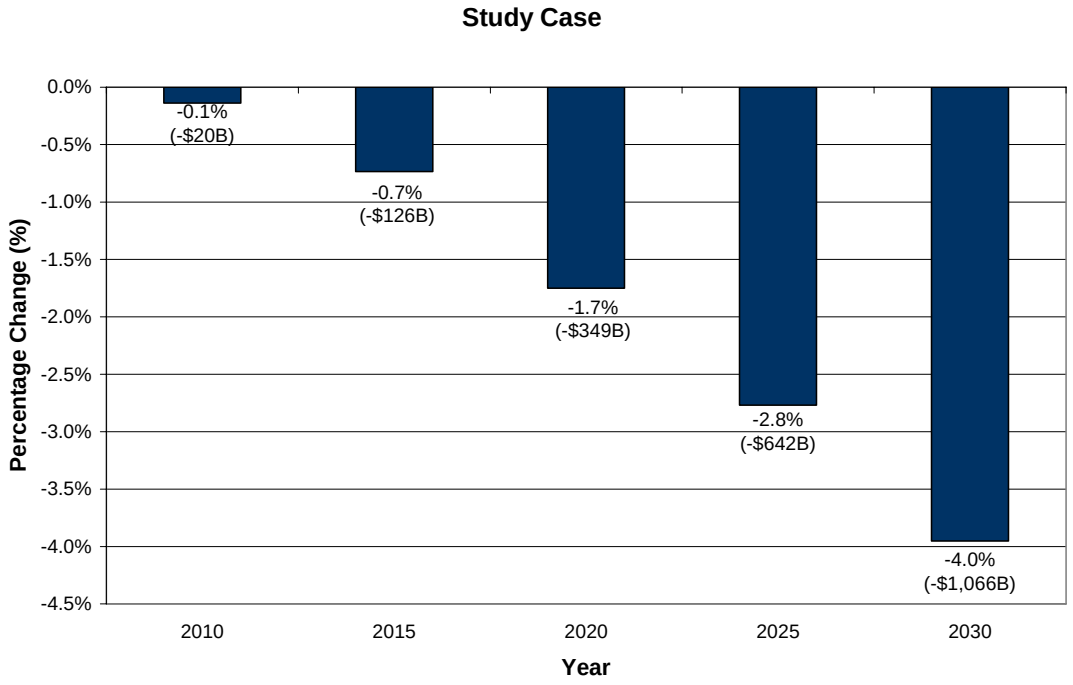


However by 2020, U.S. aggregate investment is projected to be 2.5% (or $121 billion) below the baseline level. By 2030, the result of the proposed legislation is estimated to reduce aggregate investment in the U.S. by $219 billion, or 3.4% of total baseline investment. As with the employment losses, the impact would likely be uneven both across industries and among regions and would resemble that of employment losses.

2.2.5. Gross Domestic Product

The estimated impacts on GDP would follow the pattern already evident in the estimated results for investment and employment. Higher production costs and lower household purchasing power interact. Employment, consumption and investment would tend to fall. Total economic activity, measured as GDP, would also decline. As the provisions of the legislation begin to take effect, the GDP impact is projected to become more pronounced (Figure 2-8). In 2020, the GDP is estimated to decline by 1.7% below the baseline level (or by $349 billion), and by the year 2025 it is projected to decline further to 2.8% below baseline. By the year 2030 the GDP is estimated to decline by 4.0% or over 1 trillion dollars in real terms relative to the baseline. Figure 2-8 summarizes the pattern of estimated GDP losses through time.

Figure 2-8: Projected Impact on GDP Due to Proposed House/Senate Energy Legislation

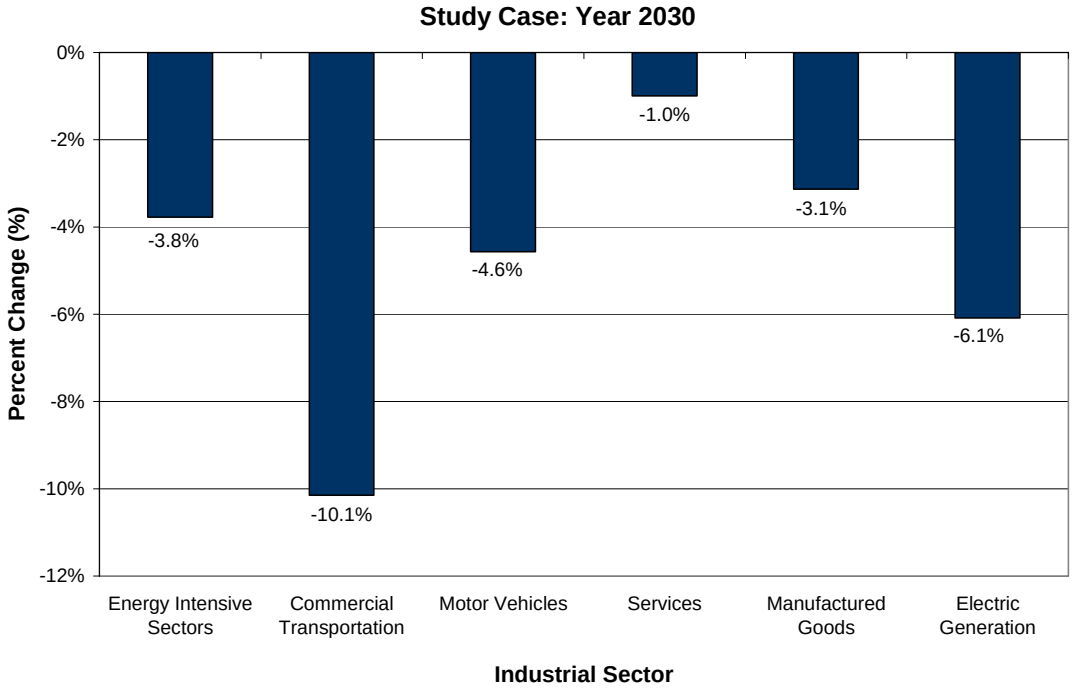


As energy supply declines and energy sources become more expensive, economic activity is projected to decline relative to the economy's business-as-usual course.

2.2.6. Industry output

As noted above, although the projected declines in economic activity are pervasive, they are uneven. Some industries would likely experience larger cost increases than others do, and corresponding demand impacts across goods and services would also be uneven. Figure 2-9 shows the estimated impact on output by industrial sector in 2030 when the legislation's provisions have been fully phased in.

Figure 2-9: Projected Impact on Output by Industrial Sector Due to Proposed House/Senate Energy Legislation



The projected impacts are most pronounced in the industries directly impacted by the legislation. The commercial transportation sector is estimated to be most heavily affected, declining roughly 10% below the baseline level in 2030 as under these provisions it would likely be required to use more costly and less available fuels, which are a significant component of its cost structure. Motor vehicles are projected to become more expensive for consumers as manufacturers would likely build more expensive vehicles to comply with the more stringent CAFE standards. These higher costs are estimated to result in reduced sales. Motor vehicle production is estimated to decline by roughly 5% below the baseline level in 2030.

Meeting the proposed RPS provision could require constructing generators with higher lifecycle costs than conventional fuel fired generators. These higher costs are estimated to result in end-users reducing their demand for electricity by roughly 6% below the baseline by 2030.

Energy costs for the energy intensive sectors are projected to increase as they do for manufactured goods resulting in estimated higher costs and reduced output. The energy intensive sectors' outputs in 2030 are estimated to decline by roughly 4% relative to the baseline, and manufacturing goods output is estimated to decline by approximately 3% (also relative to the baseline level) in 2030.

3. METHODOLOGY

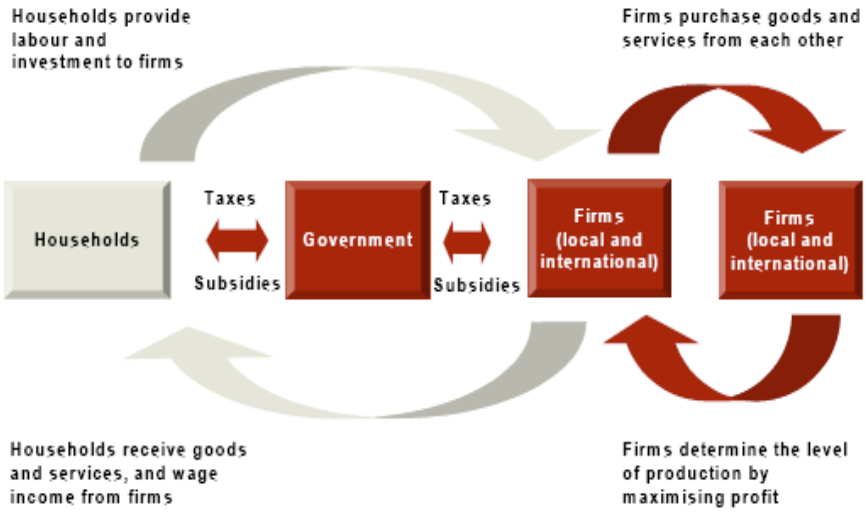
3.1. MODEL DESCRIPTION

In conducting this analysis for the American Petroleum Institute (API), CRA International combined two of its widely accepted state-of-the-art economic models: the Multi-Region National (MRN) model and the North American Electricity and Environment Model (NEEM). The linked model approach makes it possible to understand the economy-wide impacts of specific energy policies, while examining the specific impacts on the U.S. economy in detail.

3.1.1. Overview of the MRN sub-model

The top-down component of the integrated MRN-NEEM model is tailored from CRA International's Multi-Region National (MRN) model. MRN is a forward-looking, dynamic computable general equilibrium (CGE) model of the United States. It is based on the theoretical concept of an equilibrium in which macro-level outcomes (e.g., consumption and investment) are driven by the decisions of self-interested consumers and producers. The basic structure of CGE models, such as MRN, is built around a circular flow of goods and payments between households, firms, and the government, as illustrated in Figure 3-1.

Figure 3-1: Circular Flow of Goods and Services and Payment Figure



3.1.2. Overview of the NEEM sub-model

The North American Electricity and Environment Model (NEEM) fills the need for a flexible, partial equilibrium model of the North American electricity market that can simultaneously

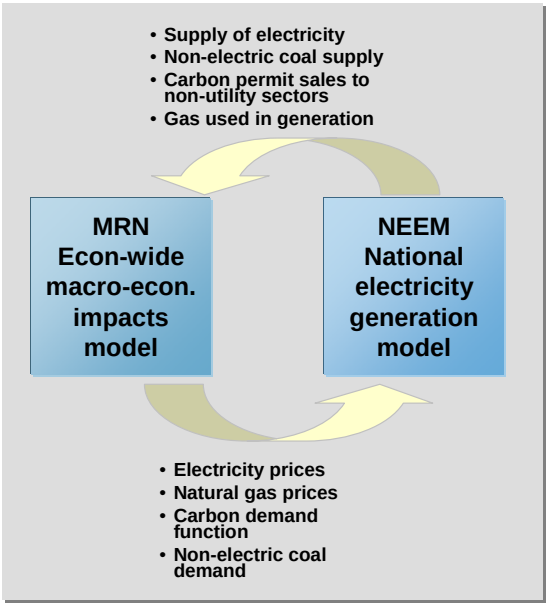
model both system expansion and environmental compliance over a 30- to 50-year time frame.

The model employs detailed unit-level information on all of the generating units in the United States and large portions of Canada. In general, coal units over 100 MW are represented individually in the model, and other unit types are aggregated. NEEM models the evolution of the North American power system, taking account of demand growth, available generation, and environmental technologies, and environmental regulations both present and future. The North American interconnected power system is modeled as a set of regions that are connected by a network of transmission paths.

3.1.3. MRN-NEEM integration methodology

The MRN-NEEM integration methodology follows an iterative procedure to link the top-down and bottom-up models. The method utilizes an iterative process where the MRN and NEEM models are solved in succession, reconciling the equilibrium prices and quantities between the two. The solution procedure, in general, involves an iterative solution of the top-down general equilibrium model given the net supplies from the bottom-up energy sector sub-model followed by the solution of the energy sector model based on a locally calibrated set of linear demand functions for the energy sector outputs. The two models are solved independently using different solution techniques but linked through iterative solution points (see Figure 3-2).

Figure 3-2: MRN-NEEM Iterative Process



3.2. STUDY CASE DESCRIPTION

The study case considered seven key proposed policies that are currently under consideration by Congress. These are listed and briefly described in Table 3-1.

Table 3-1: Description of Study Case Provisions

Provision	Description
Oil Savings Program	Would require reductions in oil use of 10 million barrels per day by 2031
Renewable Fuel Standard (RFS)	Would mandate 36 billion gallons of renewable fuel use by 2022
Tax Provisions	Would increase taxes on the oil industry by an estimated $15 billion to fund renewable energy and energy efficiency programs
Price Gouging	Would prohibit gasoline "price gouging" during presidentially-declared emergencies and would establish penalties
Renewable Portfolio Standard (RPS)	Would require utilities to obtain 15% of their power from renewable sources by 2020; publicly-owned utilities and rural cooperatives would be exempted
Corporate Average Fuel Economy (CAFE) Standard	Would require minimum combined light vehicle standards of 35 miles per gallon by 2020
Access Restrictions	Would repeal some supply incentives of the Energy Policy Act of 2005, would add penalties for unpaid royalties, and impose access restrictions aimed at resource conservation

3.2.1. Uncertainty with respect to the study case

A set of uncertainties pertains to future costs associated with the provisions included in any final form of legislation. The provisions under consideration include explicit mandates and implicitly rely upon technologies whose costs are uncertain both today and in the future. Furthermore, technological change is notoriously hard to predict as are many economically important commodity prices.

The study case will incorporate optimistic assumptions about future costs, and it will assume that the oil and natural gas tax provisions are as those now in the House bill. A more costly set of provisions including less optimistic assumptions about future costs and consideration of the initial Senate $30 billion oil and gas industry tax increase would lead to increased adverse economic impacts over an above what is estimated in this report.

The key areas of uncertainty include:

- The costs of alternative fuels;
- The level of additional tax burden placed on oil and gas producers;
- Cost impacts of certain royalty provisions pertaining to oil and gas leases in the Gulf of Mexico;
- Impacts on resource availability from access limitations proposed to apply to the American West;
- The costs of saving electricity through additional demand side management (DSM) measures; and
- The per vehicle cost of improving auto and light truck fuel economy.

Table 3-2 presents the parameter values related to the key legislative provisions that were used in the study case.

Table 3-2 Parameter Values of Key House/Senate Energy Provisions

Provision	Description	Assumptions
Oil Savings Program	Would require reductions in oil use of 10 million barrels per day by 2031	Yes
Renewable Fuels Standard (RFS)	Would mandate 36 billion gallons of renewable fuel use by 2022	Lower cost for corn and cellulosic ethanol
Tax Provisions	Would increase taxes on the oil industry by an estimated $15 or $30 billion over a 10 year period to fund renewable energy and energy efficiency programs	$15 billion over 10 years in tax provisions
Price Gouging	Would prohibit gasoline “price gouging” during presidentially-declared emergencies and would establish penalties	No cost on the economy
Renewable Portfolio Standard (RPS)	Would require utilities to obtain 15% of their power from renewable sources by 2020; publicly-owned utilities and rural cooperatives would be exempted	Demand-side management can meet up to 4% of the 15% RPS
Corporate Average Fuel Economy (CAFE) Standard	Would require minimum combined light vehicle standards of 35 miles per gallon (mpg) by 2020	Incremental light vehicle cost of $200 per additional mpg
Access Restrictions	Would repeal some drilling incentives of the Energy Policy Act of 2005, would add penalties for unpaid royalties, and impose access restrictions aimed at resource conservation	50% of Roan Plateau, 50% of split estates become uneconomic

3.3. KEY ASSUMPTIONS

3.3.1. Oil savings program:

This provision is in the Senate bill, and it would mandate oil use cuts of 10 million barrels per day (MBD) by 2031. The provision specifies reductions of 2.5 MBD by 2016 and 7 MBD by 2026.[1] (Sec. 251)

- The Senate bill calls for reductions from the business as usual (BAU) path but does not specify how business as usual is to be computed. CRA assumed that the BAU would be the Energy Information Agency's AEO 2007 forecast.

- Because the model generates a solution every 5 years starting in 2010, we assume the required reductions apply one year earlier than stated. In addition, to provide a smoother transition, the study assumed a reduction of 4.75 MBD in 2020 (i.e., the average of the 2016 and 2026 requirements).

3.3.2. Renewable Fuels Standard (RFS):

This Senate provision would mandate renewable fuel use of 36 billion gallons by 2022, with specific incremental increases each year between 2008 and 2022. (Sec. 111) It would mandate 21 billion gallons by 2022 for advanced biofuels and specifies incremental increases each year between 2016 and 2022. (Sec. 111) In addition, from 2023 onward advanced biofuels would be required to comprise at least 60% of all biofuels.

Table 3-3 gives the minimum biofuel levels – total equals conventional corn based ethanol plus advanced biofuel (cellulosic ethanol). From 2022 onward, we assume that the share of biofuels in the transportation fuels market is equal to the share reached in 2022. In other words, after 2022, biofuels use increases at the same rate as demand growth in the transportation fuels market. In addition, from 2023 onward advanced biofuels would be required to comprise at least 60% of all biofuels consumption.

[1] We assume a reduction of 5 MBD by 2020.

Table 3-3: Renewable Fuels Standard (RFS) (billions of gallons)

Year	Total Biofuels (billions of gallons)	Advanced Biofuels (billions of gallons)
2010	12	-
2015	15	-
2020	30	15
2025	37.4	22.4
2030	39.7	23.8

We assume that there is a volume limitation on the total amount of corn based ethanol that can be produced without significantly disrupting the agricultural and related markets. The physical limitation is about 20 billion gallons per year that holds over the time frame of the analysis.

The costs for the biofuels are based upon a recent MathPro study[2] and are summarized in Table 3-4 below.

Table 3-4: Cost Components to Produce Biofuels

	Corn-based Ethanol	Cellulosic-based Ethanol
Capital	$0.36	$1.28
Operating Costs	$1.98	$2.35
By-Product Credit	($0.38)	($0.10)
Total	$1.96	$3.53

Assumptions about future technology are important to assessing the RFS provisions. Among the assumptions employed by this study are the following:

- The refining of gasoline is a mature technology and process costs are unlikely to change dramatically over the time frame of the study.

[2] Math Pro Inc., "National Costs of Increased Ethanol Mandate Volumes", prepared for the American Petroleum Institute, September 2007

- Competition for cropland, adverse impacts on agricultural markets, and water resources limits annual corn-based ethanol production to slightly more than 20 billion gallons over the time frame of the study.

- Corn fermentation technology is mature and future costs are unlikely to change significantly over the time frame of the study.

- The costs of growing corn (given the 20 billion gallon limit) are likely to be stable on net over the time frame of the study.

    - Improvements in seeds will tend to diminish costs.

    - Rising demand for cropland is likely to raise the marginal cost of production.

- The future cost path of cellulosic ethanol production is uncertain.

    - The study case assumes a 20% reduction in costs by 2050

    - There is no guarantee that production costs will decline over the time frame of the study.

- This study utilizes a lower production cost estimate of corn-based ethanol from a recent MathPro Study in 2020 of $1.96 per gallon (in 2006 dollars). MathPro also reports a higher cost estimate of $2.08 per gallon (in 2006 dollars).

- Also based on the MathPro report, this study utilizes a low cost estimate for cellulosic ethanol in 2020 of $3.53 per gallon. MathPro also reports a higher cost estimate of $4.03 (in 2006 dollars).

- For both corn-based and cellulosic ethanol, the differences in the possible future capital cost estimates for production capacity determine in large part the differences between estimated high and low costs.

3.3.3. Tax provisions:

The House bill is projected to raise oil industry taxes by over $15 billion to fund renewable energy and energy efficiency incentives. (Sec 13011, 13012, 13013) Although the final Senate bill does not include any tax provisions, an earlier draft had included $30 billion in oil and gas industry taxes. This analysis considers only the House tax provisions. The specific provisions of the House legislation are as follows:

- (Sec. 13011) Repeals oil and gas industry's eligibility for the Section 199 deduction on income from domestic manufacturing. Projected to raise $11.4 billion over 10 years.

- (Sec. 13012) Extends the amortization period for certain exploration expenses from five to seven years for major integrated oil companies. Projected to raise $103 million over 10 years.

- (Sec. 13013) Alters tax treatment related to foreign oil and gas extraction. Projected to raise $3.6 billion over 10 years.

Analyzing these provisions requires economic assumptions about how the taxes would be levied.

- The analysis assumes that the split between upstream and downstream is 2/3 on upstream and 1/3 on downstream, based on the approximate current relative magnitude of revenues from those two sectors for major U.S. companies.

- Because the model represents the natural gas sector as one vertically integrated sector, the tax impacts on natural gas can only be estimated at the upstream level. Therefore, the analysis divided the tax impacts among the crude extraction, natural gas, and refining sectors into equal shares.

- Since it is assumed in this analysis that these taxes apply only over 10 years, we assume these taxes apply in 2010 and 2015 and sunset in 2020. The taxes are modeled as ad valorem taxes on the appropriate sectors where the tax rate is set at the appropriate level to raise $15 billion over the 2010-2020 period.

- As stated above, the tax provisions were modeled over a ten year period from 2010 to 2020, the time period for which official tax revenue estimates from the Joint Committee on Taxation were available. In actuality, the proposed legislation does not call for these provisions to sunset after 10 years. By inference, the estimated economic impacts on the oil and gas industry in this report are likely understated.

3.3.4. Price gouging:

The Senate bill creates a prohibition on gasoline "price gouging" during presidentially declared emergencies and establishes civil and criminal penalties for violators. The House passed a separate, stand-alone price gouging bill earlier this year. (Sec. 603)

Based on the analysis in a study by Montgomery, Baron and Weisskopf,[3] the annual cost of these provisions was estimated to be $380 million. This estimate was based on the conclusions of the study that if price gouging legislation had been in effect, the economic costs of Hurricanes Katrina and Rita would have been increased by $1.9 billion dollars. Assuming that a disruption of gasoline supplies of similar magnitude were to occur every five

[3] Montgomery, W. David, Robert E. Baron, and Mary K. Weisskopf, "Potential Effects of Proposed Price Gouging Legislation on the Cost and Severity of Gasoline Supply Interruptions," Journal of Competition Law & Economics, 2007, 3(3), pp. 357-397.

years gives an estimated average economic loss that could be expected from adoption of this provision. However, for purposes of the study case modeled here, the proposed price gouging legislation was assumed to have no negative impact.

3.3.5. Renewable Portfolio Standard (RPS):

The House bill would require utilities to provide 15 percent of their power from renewable sources by 2020. The provision would exempt publicly owned utilities and rural electric cooperatives. It would establish a credit trading mechanism of up to 4 percent—or roughly a quarter of the mandate—that may be fulfilled with energy efficiency measures. (Sec. 9611)

Using the MRN-NEEM model which incorporates a detailed representation of the electric power sector, the analysis imposed RPS standards on the effective generation from investor owned utilities while exempting the share of generation from publicly owned utilities and rural electric cooperatives.

- The RPS requirement was lowered by 25% to reflect the fact that about 25% of generation comes from rural electric co-ops and publicly owned utilities.
- In addition, because up to 3% (75% * 4%) of the RPS may be met with energy efficiency Demand Side Management (DSM) programs, the analysis assumed in the low impact scenario that the DSM programs provide consumers with the same level of electricity service as they would have had if they had consumed the additional power. For example, the analysis assumed that consumers see no loss in amenities by replacing incandescent light bulbs with fluorescent light bulbs and that fluorescent light bulbs have the same retail price (adjusted for hours of service).
- Higher cost would be incurred if it turns out that power generators meet the entire RPS requirement with renewables. However, the lower cost assumption was assumed in this study.
- The MRN-NEEM model includes the costs of building and operating renewable power facilities.
- The model also embodies elasticity parameters that estimate changes in demand resulting from higher power rates.

3.3.6. Corporate Average Fuel Economy (CAFE) standard:

The Senate bill directs the Secretary of Transportation to implement CAFE regulations that achieve a combined standard for passenger cars and light trucks of at least 35 miles per gallon by 2020. For model years 2021 through 2031, DOT would have to establish the "maximum feasible" standard for the fleet. (Sec. 502) There is no comparable provision in the House bill.

- Alternative fueled vehicles are assumed to have the same MPG on a gasoline gallon equivalent basis as gasoline powered vehicles.

- The latest National Academy of Sciences (NAS) study of CAFE limits provides high and low estimates of the costs of improving new vehicle fuel economy for cars and light trucks.

- The model uses these estimates to assess the range of possible impacts on new vehicle costs.

- Although CAFE standards are likely to stimulate additional driving by reducing cost per mile traveled, this effect -- which lowers the cost-effectiveness of such standards -- was not included in the analysis.

- The study case assumes the NAS's low cost estimate for improving vehicle fuel efficiency of $200 per vehicle per mpg.

3.3.7. Restricting access, raising royalty payments for domestic oil production:

The House Bill would scale back several Energy Policy Act of 2005 (EPA 2005) provisions aimed at expediting drilling for oil and natural gas on federal lands. It also includes provisions that address environmental rules and guidelines for energy development. (Sec. 7101-7106) Several provisions would repeal or restrict measures enacted in the Energy Policy Act of 2005 that are designed to encourage domestic oil and natural gas production.

- The House bill's provisions would restrict access to resources on split estates. The analysis assumes that the provision decreases the quantity of resources that can be economically extracted from the western U.S.
    - Using the EPCA Phase II study[4], the analysis estimates the quantity of resources that could presently be developed on split estates (Table 3-5).
    - The study case assumes that development of half of these resources would become uneconomic under the proposed restrictions.
- The House bill would also eliminate drilling activity on the Roan Plateau.
    - The analysis used the Environmental Impact Statement (EIS) study[5] for the Roan Plateau to estimate the oil and natural gas resource potential for the Roan Plateau.
    - The study case assumed that the provisions to restrict access to the plateau would result in 50% of the resource becoming either technically inaccessible or uneconomic to recover.

[4] U.S. Department of the Interior- Bureau of Land Management, *Scientific Inventory of Onshore Federal Lands' Oil and Gas Resources and the Extent and Nature of Restrictions or Impediments to Their Development — Phase II Cumulative Inventory*, Table 2-8, Figures 2-1 to 2-11

[5] BLM Colorado State Office, "Roan Plateau Planning Area", Oil and Gas Reasonable Foreseeable Development, August 2006

- The House bill would establish new penalties for underpayment of royalties for oil and gas leases and would require increases in the number of Minerals Management Service audits. (Sec. 7215)
    - The analysis estimates the payments that oil and gas producers would have to make under these provisions.
    - The model uses an ad valorem excise tax on oil and gas production in the Gulf of Mexico, set to recover the amount of payments required under the rule, to simulate the effects of this provision. The payments are based on past royalties, but become in substance a fee that must be paid for future access.
    - The model then calculates the impact of this tax to determine the policy's implications for energy markets.

Table 3-5: Undiscovered Resource Potential as Split Estate

Study Area	Undiscovered Resources (Split Estate)	
	Liquids (MMbbls)	Natural Gas (BCF)
Northern Alaska	171	655
Uinta/Piceance Basin	3	593
Paradox/San Juan Basins	3	248
Montana Thrust Belt	2	63
Powder River Basin	354	3513
Wyoming Thrust Belt	2	14
Greater Green River Basin	58	1835
Denver Basin	0	1
Florida Peninsula	0	0
Black Warrior Basin	0	0
Appalachian Basin	0	24
Total	593	6947

Share of total visually estimate from EPCA Phase II study, Figures 2-1 to 2-11

4. BACKGROUND

Congress is considering new energy policy legislation. Bills have passed both houses of Congress and congressional leaders are considering options for reconciling the two versions and moving toward final passage. CRA International has completed this study to estimate both the costs and other related economic impacts of possible reconciled versions of these bills.

> In the first session of the 110th Congress, the House and the Senate passed two markedly different versions of omnibus energy efficiency and renewable energy legislation . . . House-passed H.R. 3221 and Senate-passed H.R. 6. Key legislative challenges remain. First, there are significant differences between the two bills. Second, because the House and Senate have passed different measures, further action will be required in at least one chamber before a conference committee could be arranged.

The Senate passed its version of H.R. 6, the proposed Renewable Fuels, Consumer Protection, and Energy Efficiency Act of 2007, on June 21, 2007. Provisions of the Senate-passed H.R. 6 include appliance efficiency standards, an increase of the renewable fuel standard (RFS) to 36 billion gallons by 2022, and an increase of the combined corporate average fuel economy (CAFE) standards to 35 miles per gallon (mpg) by 2020. The legislation does not include tax provisions or a renewable energy portfolio standard (RPS).

The House passed H.R. 3221 on August 4, 2007. H.R. 3221 has tax and RPS provisions but omits both RFS and CAFE standards. A floor amendment added a 15% renewable portfolio standard (RPS). Other important House provisions would extend the Renewable Energy Electricity Tax Credit for four years and make government loan guarantees available to a wider range of projects. The legislation mandates various energy conservation standards.

The Administration has stated that the House legislation "would lead to less domestic oil and gas production, higher energy costs, and higher taxes." Other concerns included the repeal of the manufacturing tax deduction for the oil and gas industry, the application of royalty requirements for some offshore oil and gas leases, price gouging provisions, and increased authorization for clean renewable energy bonds. In the Senate bill, the Administration objects to the 35 mpg fuel economy target in the CAFE provision as well as extending CAFE to medium and heavy trucks.

This legislative activity takes place just two years after enactment of the Energy Policy Act of 2005. Energy policy's rapid return to the congressional agenda illustrates both the issue's currently high public profile and the existence of deep divisions about how best to deal with it. It also represents a sharp break with the previous era in which America had experienced two decades of relative energy policy quiescence.

4.1. STUDY OBJECTIVES

The study will estimate the collective impacts of the key provisions of the current House and Senate energy bills. Because these provisions interact and because different elements of the economy are interconnected, the task requires use of comprehensive and detailed economic models. These models simulate the operations of major features of the economy and the energy system, so that it is possible to trace the many pathways through which legislation can affect various economic sectors and activities.

The legislation involves many provisions that interact and overlap with each other. The goal of this analysis is to assess the current congressional energy bills' likely impact on key measures of economic performance. The analysis does not attempt a detailed evaluation of every provision of the House and Senate energy bills. Instead it attempts to capture the combined impacts on the national economy of the major provisions of the two bills.

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APPENDIX A: TABULATED MODEL OUTPUT

Table 1: Projected Total U.S. Consumption of Petroleum, Corn Ethanol, and Cellulosic Ethanol within the Transportation Sector, 2010-2030

	2010	2015	2020	2025	2030
Petroleum (billion gallons)					
Base Case	237.2	252.1	268.4	283.9	302.5
Study Case	235.5	228.7	217.1	206.2	190.5
Difference	-1.7	-23.4	-51.4	-77.7	-112.0
Corn Ethanol (billion gallons)					
Base Case	10.6	13.6	13.6	13.6	14.4
Study Case	12.2	15.8	19.0	19.6	20.1
Difference	1.5	2.2	5.4	6.0	5.7
Cellulosic Ethanol (billion gallons)					
Base Case	0.0	0.0	0.2	0.2	0.2
Study Case	0.0	0.0	15.1	22.7	30.2
Difference	0.0	0.0	14.9	22.5	29.9

Table 2: Projected National Level Percentage Change in End-User Costs of Goods and Services by Sector, 2010-2030

	2010	2015	2020	2025	2030
			Study Case		
Energy Intensive Sectors	0.1%	1.0%	1.5%	2.2%	3.4%
Commerical Transportation	0.0%	5.3%	8.6%	13.1%	20.6%
Motor Vehicles	0.1%	0.3%	5.5%	5.7%	5.9%
Manufactured Goods	0.1%	0.5%	0.6%	0.8%	1.3%
Electric Generation	3.2%	1.9%	1.0%	1.7%	3.8%

Table 3: Projected Change in the Number of Non-Farm Jobs Relative to Baseline Employment in Each Model Year, 2010-2030

	2010	2015	2020	2025	2030
			Study Case		
Midwest	-10,012	-61,955	-314,103	-432,391	-595,180
Great Plains	33	-41,209	-86,992	-124,599	-178,414
California	-22,078	-110,984	-281,074	-398,465	-508,357
Southeast	49,942	-164,748	-443,367	-641,067	-971,852
Oklahoma/Texas	56,125	-70,077	-189,070	-370,991	-671,337
Mississippi Valley	302	-130,003	-285,149	-475,627	-613,665
West	-19,261	-155,127	-327,325	-435,879	-594,184
Northeast	-32,685	-105,997	-211,413	-285,692	-383,920
Mid-Atlantic	-19,975	-112,445	-195,060	-279,077	-374,285
United States	**2,391**	**-952,546**	**-2,333,555**	**-3,443,789**	**-4,891,194**

Table 4: Projected Aggregate U.S. Investment, 2010-2030

Values in billion 2007 dollars

	2010	2015	2020	2025	2030
	Billion 2007$				
Base Case	$3,610	$4,185	$4,850	$5,620	$6,494
Study Case	$3,617	$4,200	$4,729	$5,435	$6,275
Difference (Study less Base)	$7	$15	-$121	-$185	-$219
Percentage Change (%)	0.2%	0.4%	-2.5%	-3.3%	-3.4%

Table 5: Projected Change in Household Purchasing Power Relative to Baseline Levels 2010-2030

Values are in 2007 dollars

	2010	2015	2020	2025	2030
Study Case	-$213	-$531	-$828	-$1,206	-$1,720

Table 6: Projected U.S. Gross Domestic Product, 2010-2030

Values in billion 2007 dollars

	2010	2015	2020	2025	2030
	Billion 2007$				
Base Case	$14,555	$17,103	$19,951	$23,194	$26,963
Study Case	$14,535	$16,978	$19,602	$22,551	$25,898
Difference	-$20	-$126	-$349	-$642	-$1,066
Percentage Change	-0.1%	-0.7%	-1.7%	-2.8%	-4.0%

Table 7: Projected Domestic Production of Natural Gas and Crude Oil, 2010-2020

	2010	2015	2020
Natural Gas Production (Quads)			
Base Case	22.3	23.3	22.6
Study Case	22.2	22.8	21.7
Percentage Change	-0.4%	-2.2%	-4.0%
Crude Oil Production (Quads)			
Base Case	12.6	12.2	12.1
Study Case	12.0	11.4	12.0
Percentage Change	-4.4%	-6.2%	-1.1%

Table 8: Projected Percentage Change in Output by Industry Relative to Base Case, 2030

Industrial Sector	Study Case
Energy Intensive Sectors	-3.8%
Commercial Transportation	-10.1%
Motor Vehicles	-4.6%
Services	-1.0%
Manufactured Goods	-3.1%
Electric Generation	-6.1%