Energy and Economic Impacts of a Proposed Windfall Profits Tax on Producers of Oil and Refined Products in the United States

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Prepared For API

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1. EXECUTIVE SUMMARY

CRA International has used its state-of-the-art MRN-NEEM and MS-MRT modeling systems to analyze the potential impacts on domestic energy markets and the economy of legislation that has been considered by the U.S. Congress to impose a windfall profits tax on producers of domestic crude oil and refined products. More specifically, the impacts estimated in this report are based upon windfall profits legislation S.2971 proposed in the 110th Congress. Such a tax would also indirectly impact natural gas producers to the extent that crude oil producers also produce natural gas. The analysis assesses how the tax would affect production and imports of petroleum and natural gas as well as key performance metrics of the United States' economy.

The report finds that the proposed increases in the tax burden on the U.S. oil and gas industry would likely result in a significant shift in investment away from the U.S. in oil and gas exploration and production activities and in oil refining. This shift could impact expected patterns of global oil and gas supply; would likely result in long-term job losses for the domestic oil and gas industry; and would likely adversely impact the broader economy. The distortional impacts on investment and trade would be clearly seen through increases in U.S. imports of crude oil, refined products and natural gas, coupled with declines in U.S. domestic production of these energy sources. The U.S. energy deficit could be magnified over the next 20 years as a result of the diversion of investment caused by increased taxes on the domestic oil and gas sector. Although this study has specifically assessed the impact of a proposed Windfall Profits Tax, similar forms of increased taxation on the industry would be expected to have directionally similar negative consequences.

IMPACTS ON ENERGY SECTOR

Specific impacts of the legislation on domestic energy markets include the following:

- A windfall profits tax on the oil and natural gas industry could result in an estimated average decline in domestic crude oil production of approximately 21-26% from baseline levels or between 1.5 to 1.9 million barrels of oil equivalent per day (MMBOE/day)[1] over the 2010–2030 period. The loss in domestic crude oil production would result in imports of crude oil increasing by 13-18% over baseline levels or approximately by 1.2 to 1.5 MMBOE/day.

[1] Crude oil and petroleum product volumes are reported in units of "barrels of crude oil equivalent" to put them on the same metric. For crude oil, barrels of crude oil equivalent are identical to barrels of crude oil. Refined petroleum product volumes are normalized to crude volumes using the relative heat rates of crude and petroleum products.

- Because many domestic crude oil producers also produce natural gas, a windfall profits tax could also result in a decline in domestic natural gas production of between 1.6-2.4 Tcf (9-13% from baseline levels) by the period 2020-2030. This loss in domestic production would in part be offset by greater reliance on foreign imports with imports increasing between 0.5-1.2 Tcf (14-55% over baseline levels) during the period 2020-2030.

- A windfall profits tax could reduce investment in domestic refineries and is estimated to result in a reduction in production of petroleum products of 410-660 thousand barrels of oil equivalent per day (MBOE/day), or 2-4% below baseline levels, during the 2010-2030 period. The loss in domestic refinery production could in part be offset by increasing foreign imports of petroleum products by 230-430 MBOE/day (15-21% over baseline levels) during the 2010-2030 period.

IMPACTS ON ECONOMIC PERFORMANCE

Negative impacts on the energy sectors lead to economy-wide economic losses. Specific impacts of the legislation on economic performance include the following:

- By 2030, the proposed legislation is estimated to cause a net loss of between 370-490 thousand total jobs from baseline levels. Regions around the U.S. would be disproportionately affected.

- By that year, the proposed legislation is estimated to reduce household consumption by between $20-$42 billion below baseline levels.

- Domestic investment by the oil and natural gas industry is projected to fall by approximately 22% from its baseline level in the year 2010. By the year 2030, this decline in investment is estimated to range between 20-25% below baseline levels.

- By 2030, GDP, a commonly used measure of total economic activity, is estimated to decline below the baseline by approximately 0.5-0.9 % or $140-240 billion.

A windfall profits tax would restrict the supply of domestically produced energy and increase U.S. reliance on foreign sources of energy. Higher energy costs would likely reduce total consumption, employment, investment, and economic output. The link between energy supply and the country's economic performance is key to understanding the pattern of the study results and central to an assessment of the implications of the proposed legislation.

In 1980, the Congress enacted a crude oil windfall profits tax on domestic oil producers. This tax was an excise tax, not a tax on profits, applied to certain categories of oil and based on the difference between the market price of crude oil and an adjusted base price for that category. A study by the Congressional Research Service[2] concluded that it failed to raise the revenues predicted due to declining oil prices in the 1980s and may have reduced domestic crude oil production by 1.2% to 8.0% while increasing imports by 3% to 13%. The tax was ultimately repealed in 1988. Though the structure of the windfall profits tax in 1980 was different than the windfall profits tax assessed in this report as explained above, this study also finds that the windfall profits tax proposed would reduce domestic production of crude oil and increase crude imports.

[2] Lazzari, Salvatore, "The Crude Oil Windfall Profit Tax of the 1980s: Implications for Current Energy Policy", Congressional Research Service, CRS Report for Congress, March 9, 2006

2. BACKGROUND

2.1 LEGISLATION

Congress has considered legislation to amend the Internal Revenue Code of 1986 to impose a windfall profit tax on producers of crude oil and refined oil products. Several bills have been proposed in the U.S. Senate. CRA International has completed this study to estimate the impacts on U.S. energy markets and the economy of one version of these bills S.2971.

In the second session of the 110th Congress, Mr. Reid (for Mrs. Clinton (for herself and Mr. Menendez)) introduced a bill (S.2971), which was referred to the Committee on Finance. The legislation would impose a tax in the amount of 50% on the windfall profits of any applicable taxpayer for any taxable year beginning 2008. Any 'applicable taxpayer' as defined by the legislation means (1) any integrated oil company or (2) any other producer or refiner of crude oil with gross receipts from the sale of such crude or refined petroleum products of more than $1 billion. The "windfall profits" as defined by the legislation means adjusted taxable income of the applicable taxpayer for any taxable year less the reasonably average profit. The 'adjusted taxable income' as defined by the legislation is the taxable income for a given year increased by interest expense deductions, charitable deductions and loss deduction carried forward and reduced by interest income, dividend income, and net operating losses. Reasonably average profit as defined by the legislation is an amount equal to the average profit reported for years 2000-2004 disregarding the year with the highest reported profit plus 10 percent of such average.

2.2 STUDY OBJECTIVES

The study will estimate the impacts of the key provisions of a windfall profits tax on the U.S. energy markets and economy. Because the tax directly impacts energy markets and has the potential to ripple throughout the economy, the task requires use of comprehensive and detailed 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 goal of this analysis is to assess the legislation's likely impact on the domestic energy market and key measures of economic performance.

3. RESULTS

CRA International has analyzed the impacts on domestic energy markets and the economy of windfall profit tax legislation that has been proposed by the U.S. Congress. The goal of this analysis was to assess how this legislation (S.2971) would affect the energy markets in the United States and impact key performance metrics of the United States' economy. This section summarizes the results of that assessment. The report finds that the proposed windfall profits tax could increase U.S. dependence on imports of energy from foreign sources and could have adverse impacts on the U.S. economy. Key findings in 2030 include estimated job losses approaching 370-490 thousand, a projected reduction in GDP of approximately $140-$240 billion and an estimated loss in household expenditures of approximately $20-$42 billion.

CRA assessed impacts of the proposed legislation using its MRN-NEEM model. 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. 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.

In order to assess the range of potential impacts from a windfall profit tax, we analyzed the proposed legislation against two different baselines. Each of these baselines presented a decidedly different outlook for the future. Baseline #1 was based upon the U.S. Energy Information Administration's Annual Energy Outlook 2008, June 2008 release; Reference Case. Baseline #2 was based upon the U.S. Energy Information Administration's Annual Energy Outlook 2008, June 2008 release; High Price Case. Therefore, the two cases analyzed the same windfall profits tax legislation, but each case assumed a different baseline; hence this section uses the notation Baseline #1 and Baseline #2 to denote the two cases that were studied.

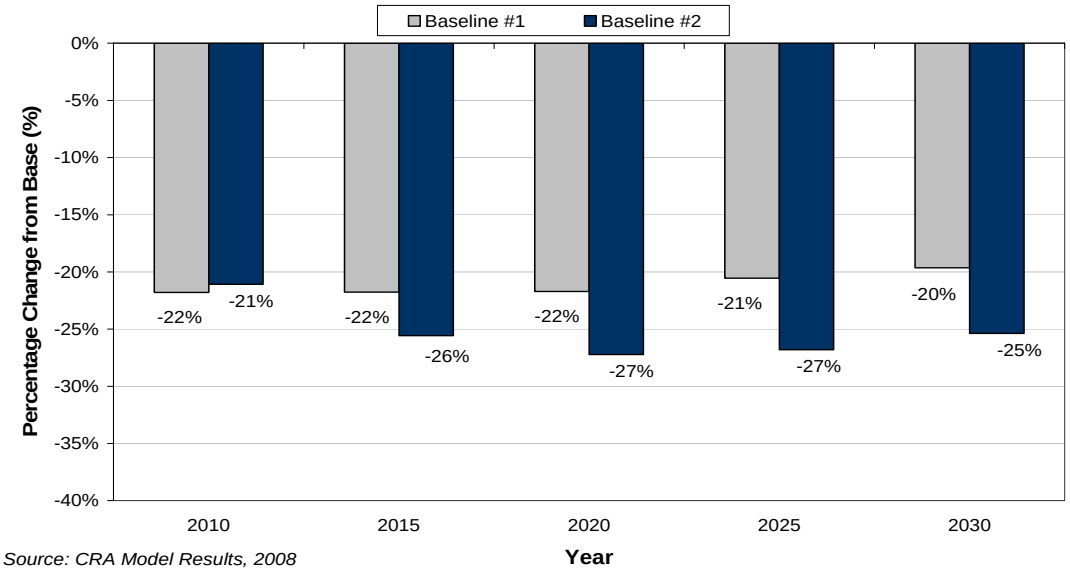
This study was undertaken and the analysis completed before the EIA's AEO2009 Early Release forecast became available. The AEO 2009 Reference Case forecasts significantly higher energy prices than those of the AEO 2008 June 2008 release. From 2015 to 2030, imported crude oil prices are approximately doubled. Distillate fuel oil prices (delivered to industrial customers) increase by approximately 50-60%. Natural gas prices (Henry Hub) increase by 14-30%.

3.1 ENERGY MARKET IMPACTS

A windfall profits tax could adversely impact the economics of drilling for crude oil and investing in projects, which sustain or expand U.S. domestic capacity to produce refined products. Furthermore, since many companies which explore for and produce crude oil also explore for and produce natural gas, any legislation, which adversely impacts their incentive to develop new crude oil prospects, could also reduce their incentives to develop natural gas prospects. As a result, there could be less investment in projects to produce crude oil and natural gas as well as to sustain or expand refined products capacity. With time this could cause an increase in dependence upon foreign supply sources to meet the United States' oil, natural gas and products demand.

Figure 3-1 below shows the decline in investment with time by the oil and gas industry as a result of the windfall profit tax. In 2010 investment is estimated to decline by approximately 21-22% from baseline levels. By the year 2030, the decline in investment from baseline levels is estimated to range between 20-25%.

Figure 3-1: Projected Impact on Domestic Investment by the Oil and Gas Industry due to Proposed Windfall Profits Tax

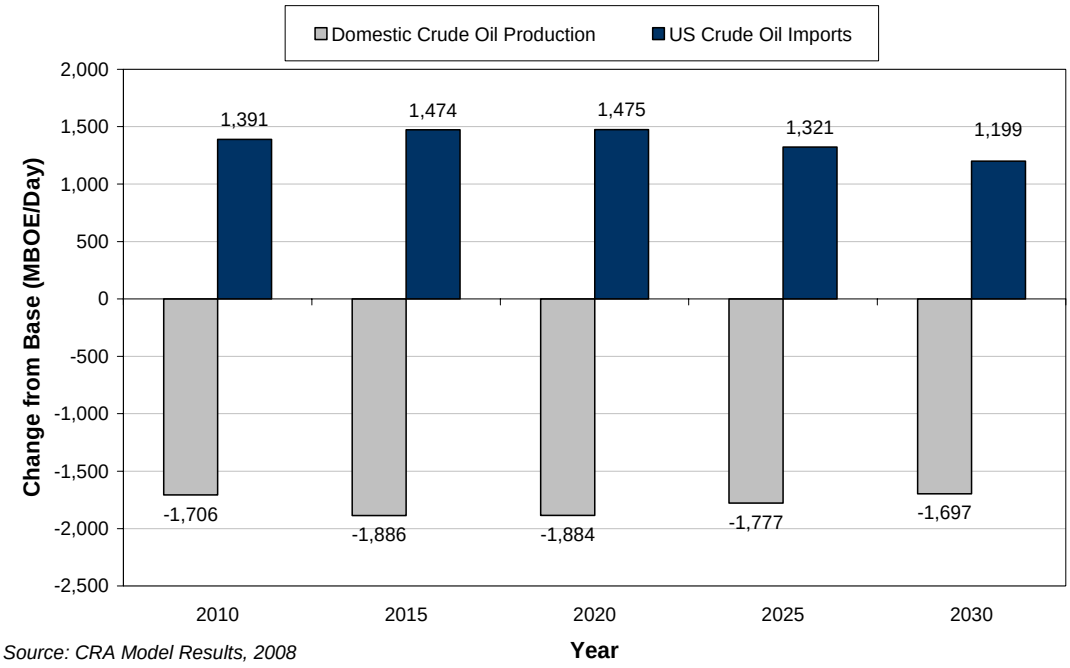


Source: CRA Model Results, 2008

3.1.1 Crude Oil Market Impacts

The introduction of a windfall profits tax could increase the costs to find and develop new sources of crude oil in the United States. As a result, fewer projects would likely be pursued and domestic production could decline. As shown in Figure 3-2 through Figure 3-5, domestic crude production is estimated to decline by approximately 21-26% relative to baseline levels in each year that the tax is in effect.[3] This is equivalent to approximately 1.5-1.9 MMBOE/day[4] less domestic crude oil production during the period. Greater imports of crude oil partially offset the loss in domestic production. During the forecast period, crude oil imports are estimated to increase by between 13-21% over baseline levels. This corresponds to an estimated increase of approximately 1.2-1.5 MMBOE/day relative to baseline levels during the forecast period.

Figure 3-2: Projected Impact on Domestic Crude Oil Production and Imports Due to Proposed Windfall Profits Tax (MBOE/day) - Baseline #1

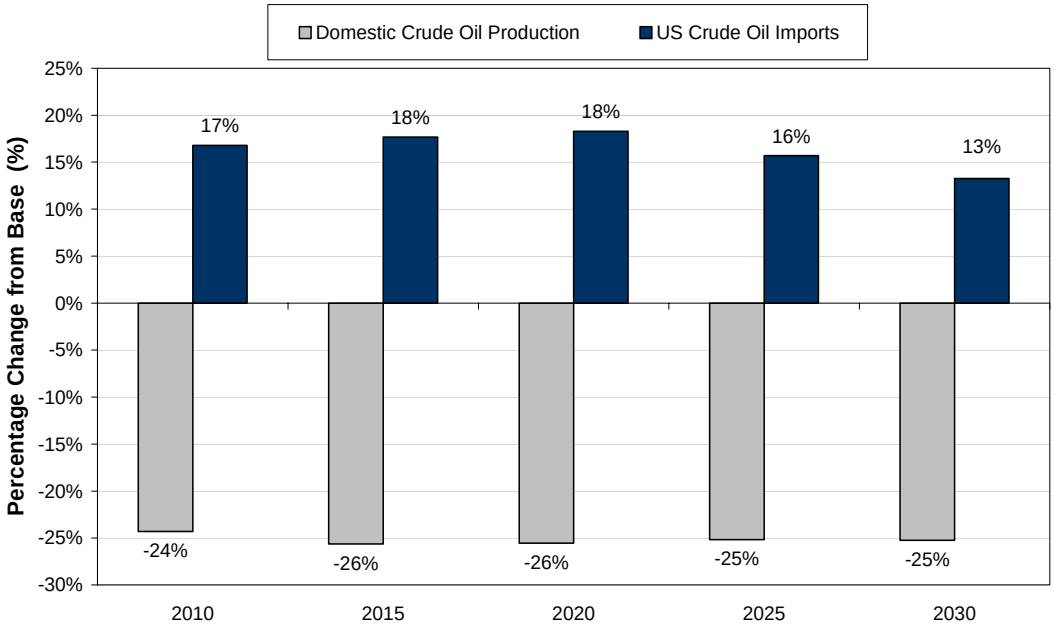


Source: CRA Model Results, 2008

[3] MBOE/day is thousand barrels of oil equivalent per day.

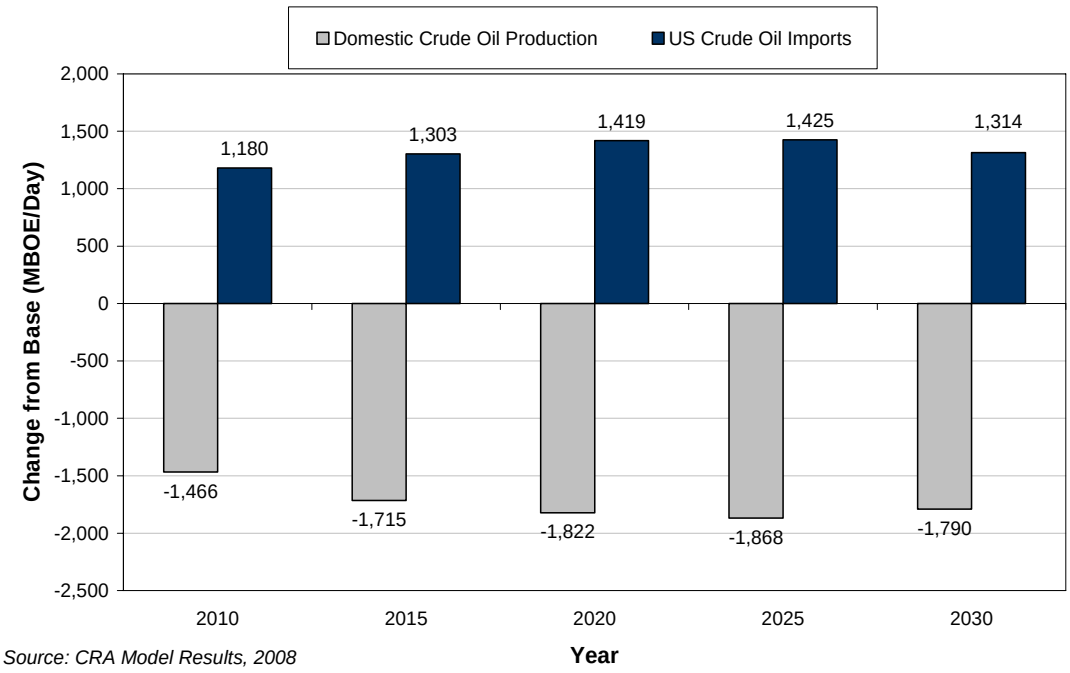
[4] MMBOE/day is million barrels of oil equivalent per day. Crude oil and petroleum product volumes are reported in units of "barrels of crude oil equivalent" to put them on the same metric. For crude oil, barrels of crude oil equivalent are identical to barrels of crude oil. Refined petroleum product volumes are normalized to crude volumes using the relative heat rates of crude and petroleum products.

Figure 3-3: Projected Impact on Domestic Crude Oil Production and Imports Due to Proposed Windfall Profits Tax (% Change) - Baseline #1



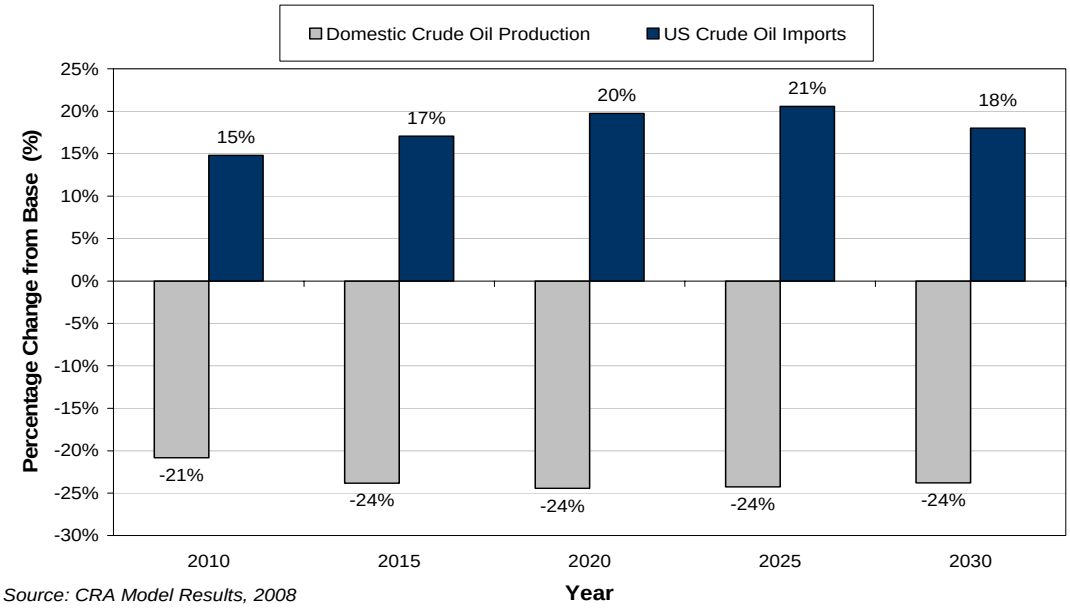
Source: CRA Model Results, 2008

Figure 3-4: Projected Impact on Domestic Crude Oil Production and Imports Due to Proposed Windfall Profits Tax (MBOE/day) - Baseline #2



Source: CRA Model Results, 2008

Figure 3-5: Projected Impact on Domestic Crude Oil Production and Imports Due to Proposed Windfall Profits Tax (% Change) - Baseline #2

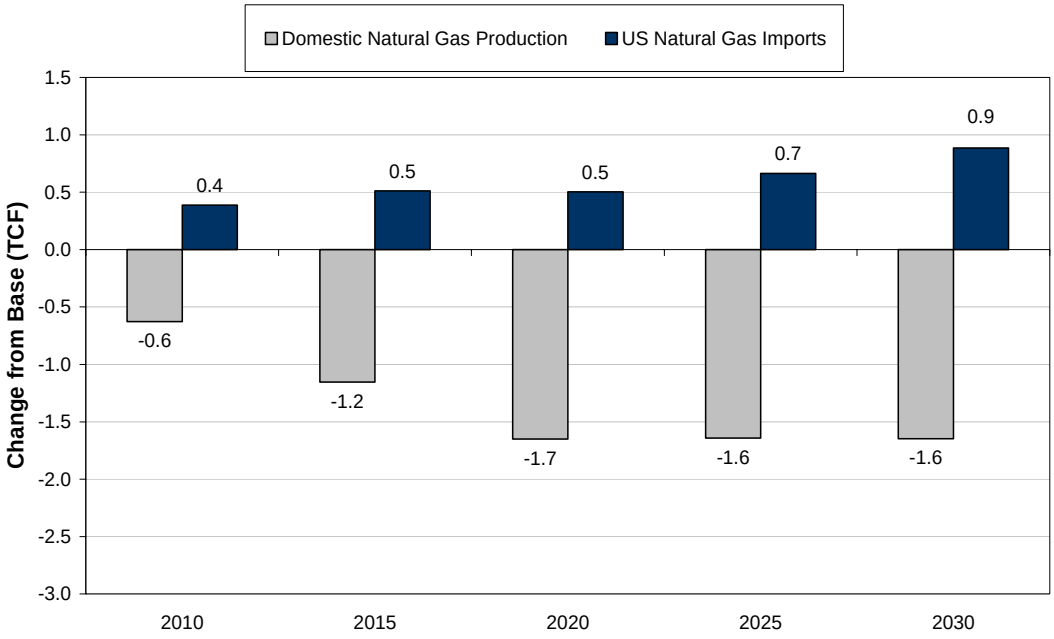


Source: CRA Model Results, 2008

3.1.2 Natural Gas Market Impacts

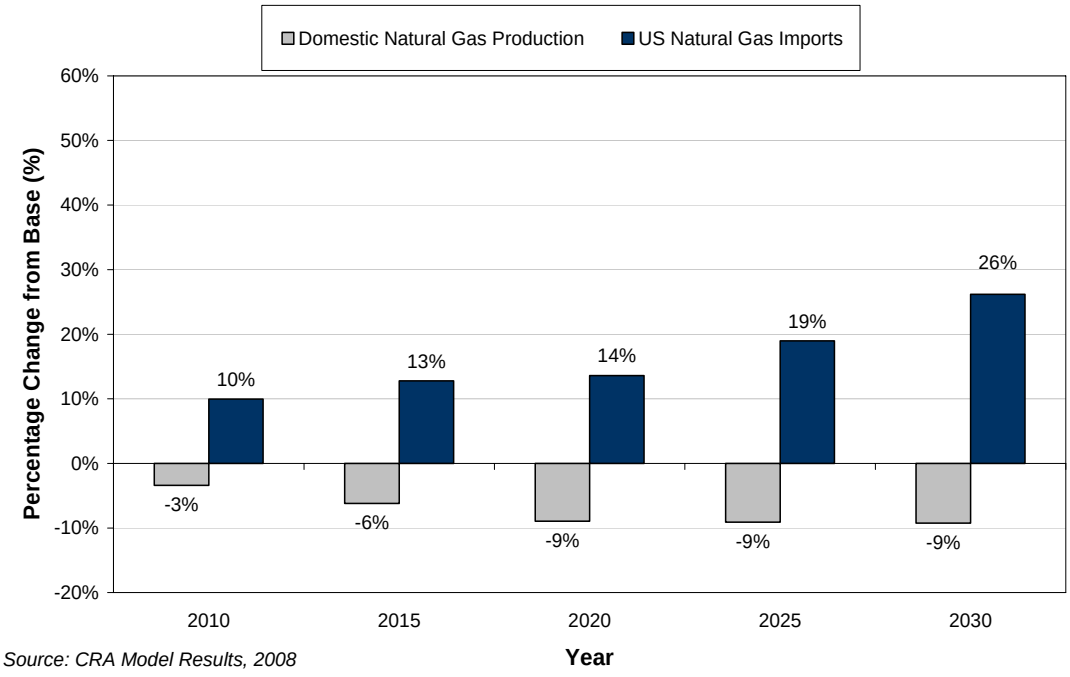
Even though the windfall profits tax is targeted at oil producers and oil refiners, it could also impact the production of natural gas because many oil producers also produce natural gas. As with oil, a windfall profits tax could reduce the number of projects that are economic to develop and thus could reduce the future production of natural gas. Figure 3-6 and Figure 3-7 show that when the proposed windfall profits tax is analyzed against Baseline #1 that natural gas production is estimated to decline by about 3% (0.6 trillion cubic feet "Tcf") in the year 2010 from baseline levels and that the decline is estimated to increase with time to about 9% below baseline levels (1.6 to 1.7 Tcf) between the years 2020 and 2030. The decline in production could in part be offset by a greater reliance on more expensive foreign imports of natural gas estimated to rise by 10% (approximately 0.4 Tcf) from its baseline level in the year 2010 to about 26% (approximately 0.9 Tcf) from its baseline level by the year 2030. When the proposed windfall profits tax is analyzed against Baseline #2 (Figure 3-8 and Figure 3-9), the impacts are estimated to be more severe in the later years with domestic production estimated to decline from about 3% (0.6 Tcf) from its baseline level in the year 2010 and estimated to worsen to a decline of as much as 13% from baseline levels (2.4 Tcf) between the years 2020- 2030. Again, the decline in production could in part be offset by a greater reliance on more expensive foreign imports of natural gas with levels estimated to exceed baseline levels by 9% (approximately 0.3 Tcf) in the year 2010 to about 55% (approximately 1.2 Tcf) more than its baseline level by the year 2030.

Figure 3-6: Projected Impact on Domestic Natural Gas Production and Imports Due to Proposed Windfall Profits Tax (TCF) - Baseline #1



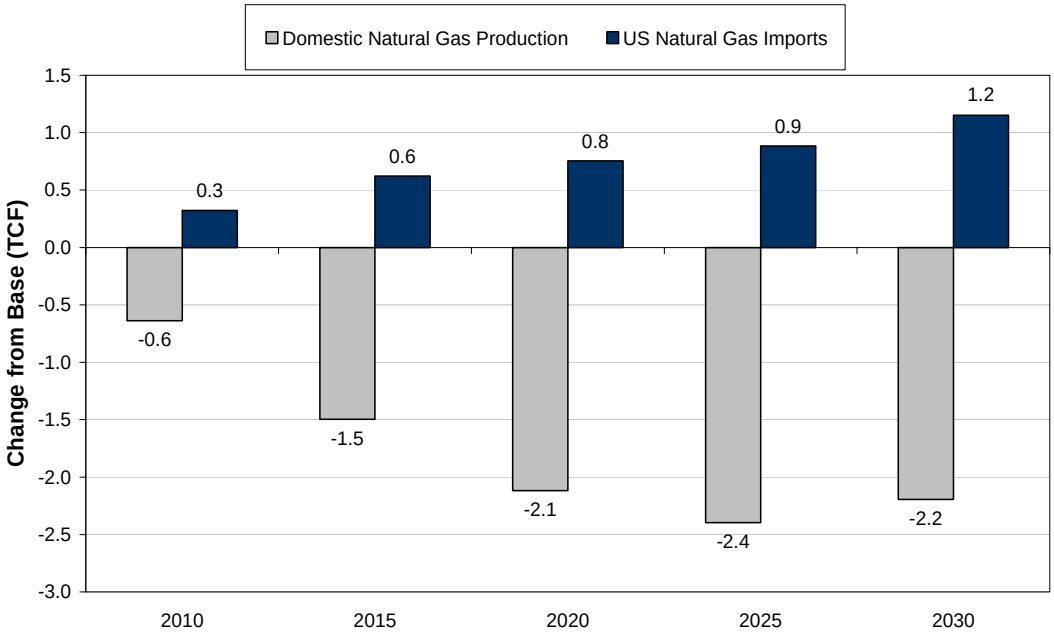
Source: CRA Model Results, 2008

Figure 3-7: Projected Impact on Domestic Natural Gas Production and Imports Due to Proposed Windfall Profits Tax (% Change) - Baseline #1



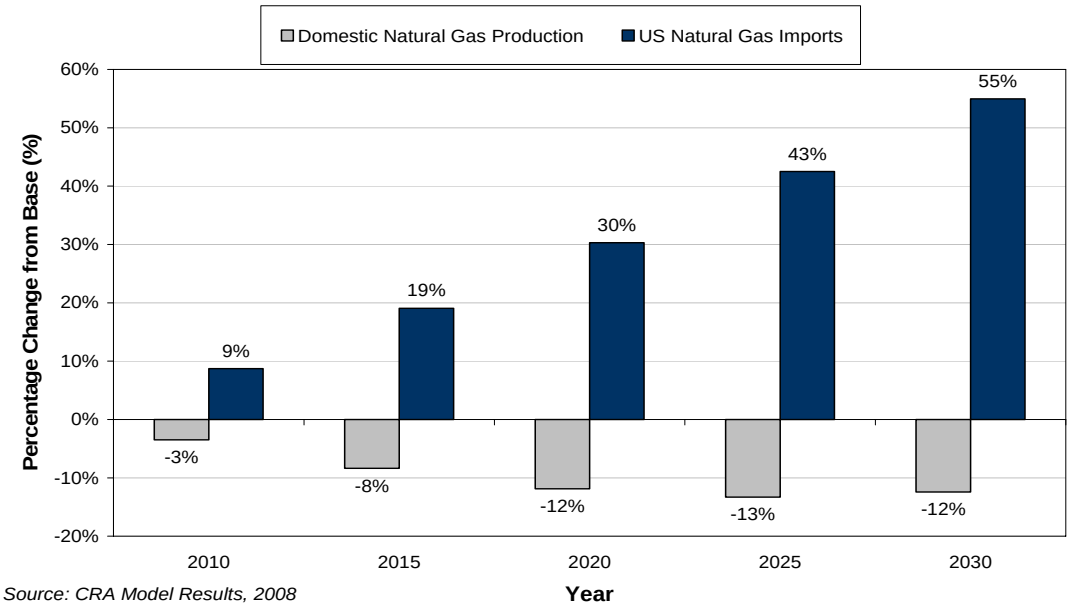
Source: CRA Model Results, 2008

Figure 3-8: Projected Impact on Domestic Natural Gas Production and Imports Due to Proposed Windfall Profits Tax (TCF) - Baseline #2



Source: CRA Model Results, 2008

Figure 3-9: Projected Impact on Domestic Natural Gas Production and Imports Due to Proposed Windfall Profits Tax (% Change) - Baseline #2

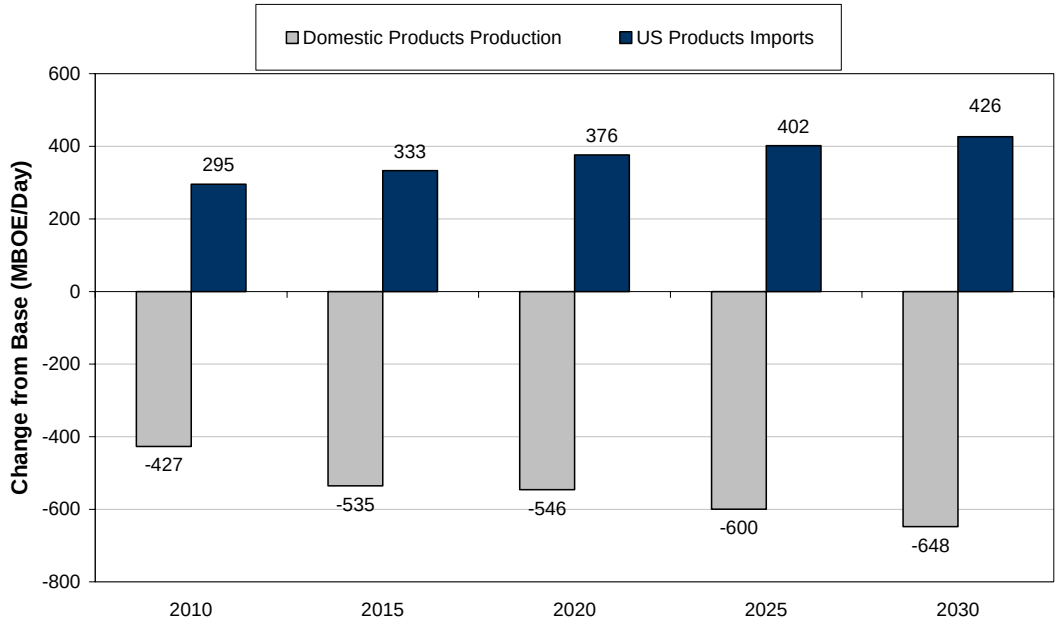


Source: CRA Model Results, 2008

3.1.3 Refinery and Petroleum Product Market Impacts

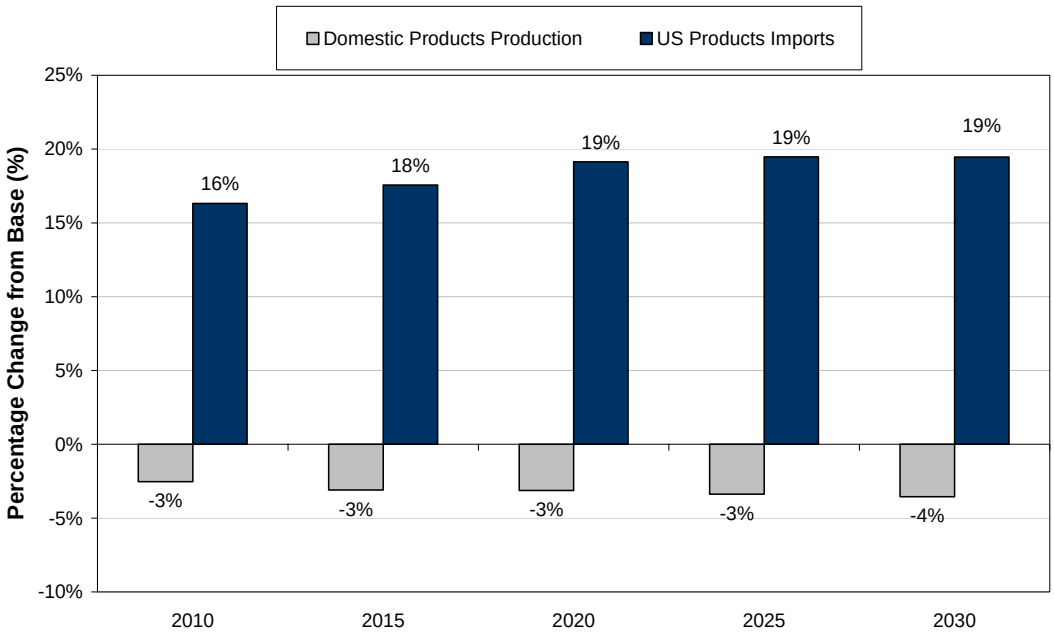
The windfall profits tax could affect many of the oil refiners in two ways. They could pay more for the crude inputs as well as potentially paying a windfall profits tax on their profits. By increasing costs, a windfall profits tax could increase their costs and adversely impact their ability to sustain and expand refiner capacity. Figure 3-10 through Figure 3-13 show that in the year 2010 a windfall profits tax could reduce domestic refinery production by 2-3% (400 MBOE/day) from baseline levels. This impact could increase with time reaching 4% (600 to 700 MBOE/day) relative to the baseline in the year 2030. The loss in domestic refinery production could be offset in part by increased imports of petroleum products from foreign sources. In the year 2010, product imports could increase by about 15-16% (200 to 300 MBOE/day) relative to baseline levels. In the later years, product imports could increase by about 19-21% relative to baseline levels (300 to 400 MBOE/day) over the forecast period.

Figure 3-10: Projected Impact on Domestic Refinery Production and Petroleum Products Imports Due to Proposed Windfall Profits Tax (MBOE/day) - Baseline #1



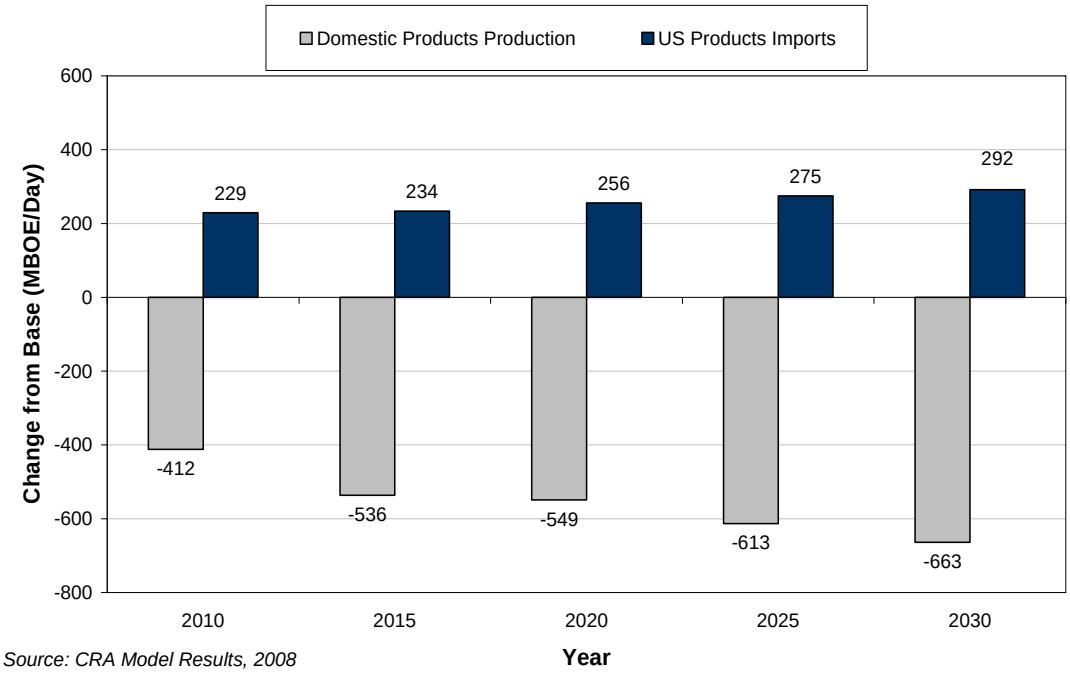
Source: CRA Model Results, 2008

Figure 3-11: Projected Impact on Domestic Refinery Production and Petroleum Products Imports Due to Proposed Windfall Profits Tax (% Change) - Baseline #1



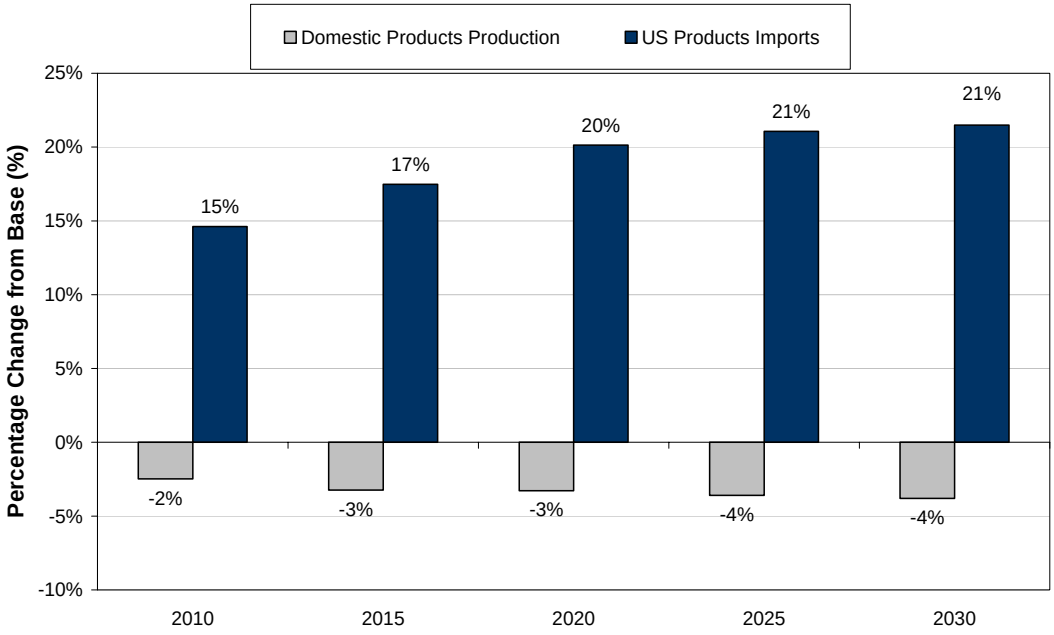
Source: CRA Model Results, 2008

Figure 3-12: Projected Impact on Domestic Refinery Production and Petroleum Products Imports Due to Proposed Windfall Profits Tax (MBOE/day) - Baseline #2



Source: CRA Model Results, 2008

Figure 3-13: Projected Impact on Domestic Refinery Production and Petroleum Products Imports Due to Proposed Windfall Profits Tax (% Change) - Baseline #2



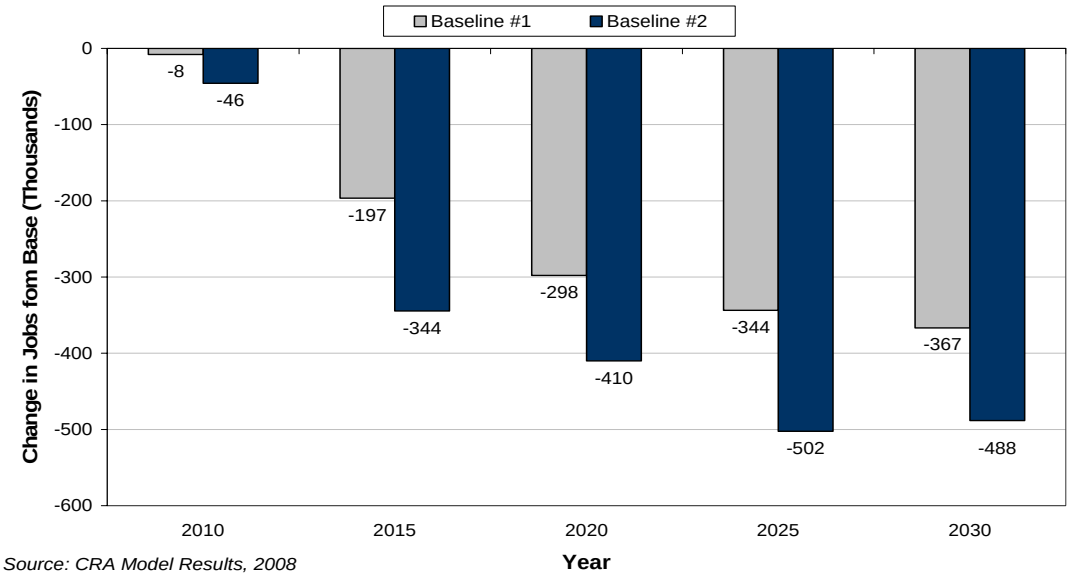
Source: CRA Model Results, 2008

3.2 ECONOMIC IMPACTS

As was seen in the previous section on energy market impacts, a windfall profits tax could have significant adverse impacts on domestic crude oil and natural gas production, and could result in increased reliance on imports of these energy products. However, the market distortions of the tax would likely not be limited solely to energy markets. The impacts also could ripple throughout energy-intensive sectors of the economy such as the transportation sector, energy-intensive manufacturing and electricity generation. The impacts could include higher end-user costs in the affected sectors, reduced aggregate investment, reduced household consumption, slower GDP growth and net job loss. The estimated economic impacts of the windfall profits tax are laid out in the figures and discussion that follows.

3.2.1 Non-Farm employment impacts

Figure 3-14: Projected Changes to Non-Farm Employment Due to Proposed Windfall Profits Tax

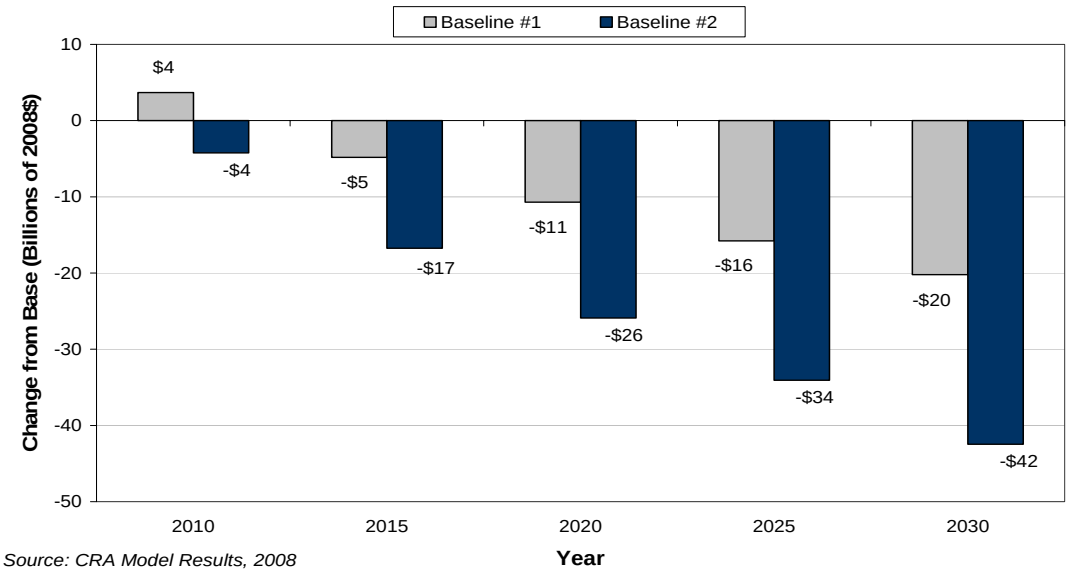


Source: CRA Model Results, 2008

A windfall profits tax, by increasing energy costs, could reduce aggregate demand for goods and services as higher energy costs work their way through various sectors of the economy. When the expected costs of energy services climb, the productivity of capital and labor tend to fall as does overall business activity. The demand for labor tends to weaken, and employment is likely to decline relative to that which would have prevailed without the windfall profits tax. Figure 3-14 illustrates that the proposed legislation could result in increasing job losses from 2010 forward. By 2020, employment is estimated to decline by 300-410 thousand jobs from baseline levels. The job loss is estimated to increase by 2030 with employment estimated to decline by 370-490 thousand jobs from baseline levels.

3.2.2 Impacts on Household Consumption

Figure 3-15: Projected Impact on Household Consumption Due to Proposed Windfall Profits Tax



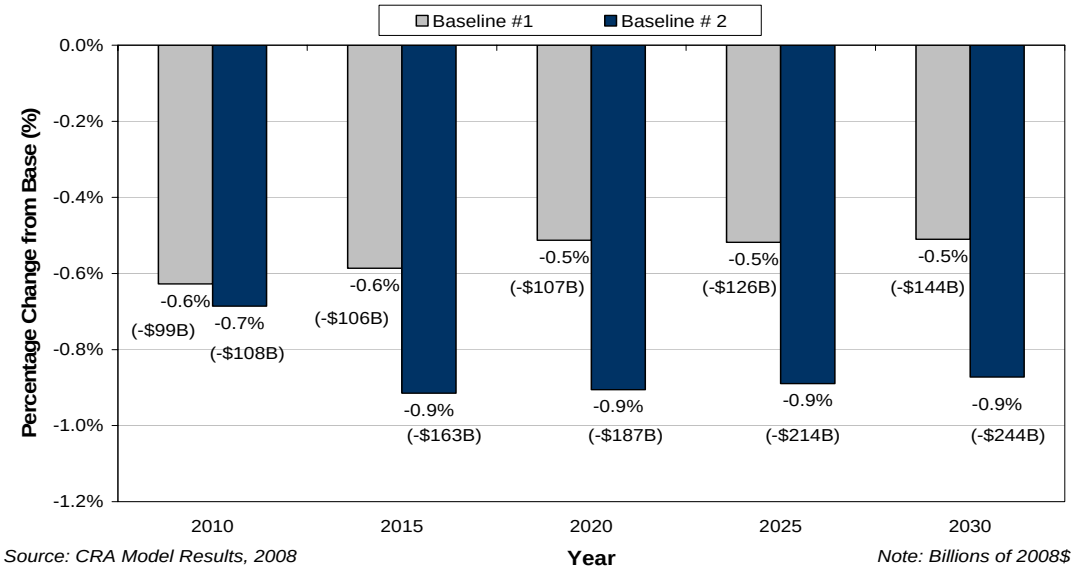
Source: CRA Model Results, 2008

Potentially higher energy costs generally mean that consumers would 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 households consume. The projected higher costs of these goods and services could be expected to magnify the loss in consumption associated with the direct purchase of energy services. Figure 3-15 estimates the total erosion of consumption that the proposed legislation could result in.

The figure reveals growing declines in household consumption given the rising burden of the tax. In 2020, households in total are estimated to experience a loss in consumption of roughly $11-$26 billion relative to the baseline levels, and by 2030, consumption is projected to decline by roughly $20-$42 billion, again, relative to the baseline levels.

3.2.3 Gross Domestic Product

Figure 3-16: Projected Impact on GDP Due to Proposed Windfall Profits Tax



Source: CRA Model Results, 2008 *Note: Billions of 2008$*

Aggregate investment is estimated to decline because of lower productivity of capital in the oil and natural gas sector, and other impacted sectors, due to the imposition of the windfall profits tax.

Declines in household consumption, aggregate investment, and a reduction in net exports result in estimated declines in GDP throughout the period of analysis.

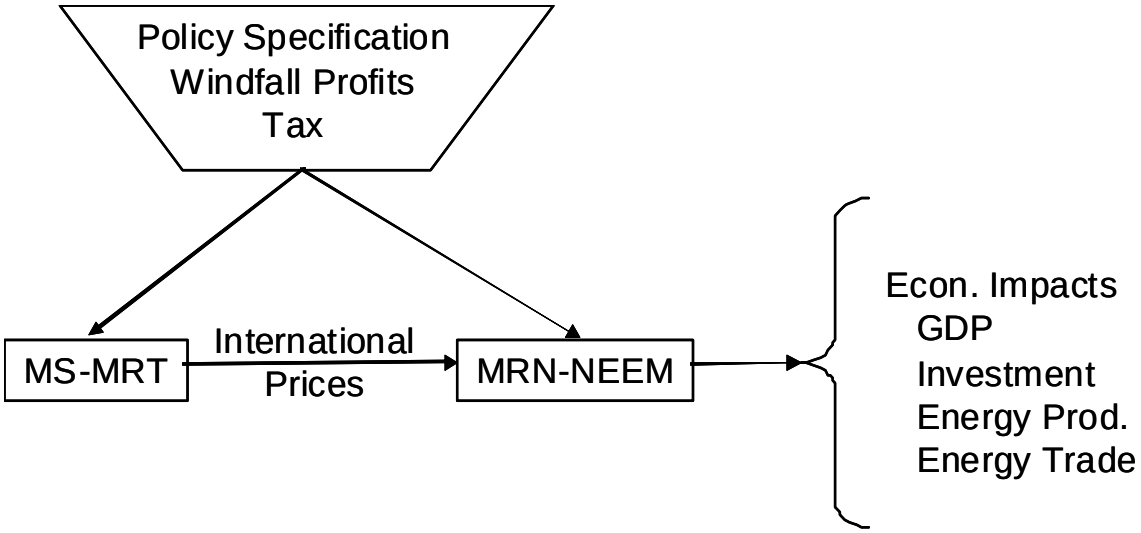
In 2020, the GDP is estimated to decline by -0.5% to -0.9% below the baseline levels or approximately $100 to $190 billion ($2008). By the year 2030, GDP is projected to decline further by -0.5% to -0.9% or approximately $140 to $240 billion ($2008) below baseline levels. Figure 3-16 summarizes the pattern of estimated GDP losses through time.

4. METHODOLOGY

4.1 MODEL FRAMEWORK

In conducting this analysis for the API, CRA International combined three of its widely accepted state-of-the-art economic models: the Multi-Region, Multi-Sector Trade (MS-MRT) model, the Multi-Region National (MRN) model, and the North American Electricity and Environment Model (NEEM). The linked model approach accounts for the international feedback effects of the U.S. adopting the proposed windfall profits tax (WPT). As Figure 4-1 illustrates, MS-MRT is used to compute the effect on international prices from the U.S.'s adoption of the WPT. These prices are fed into the MRN-NEEM modeling system, which has a much more detailed representation of the U.S. economy and hence allows for more detailed analysis of the effects of the WPT.

Figure 4-1: Linkage between MS-MRT and the MRN-NEEM modeling framework



4.2 MODEL DESCRIPTION

This section briefly describes the three models: MS-MRT, MRN, and NEEM. It also provides more information on how the models are linked.

4.2.1 Overview of the MS-MRT sub-model

MS-MRT represents the entire world at an extremely aggregated level. It is built upon the GTAP6-IEA database,[5] which includes 83 countries/regions and 23 industries. For this project, we aggregated the dataset into the following regions: USA, Europe, Other OECD, Eastern Europe and Former Soviet Union, Middle East, China and India, high income East Asia, and the rest of the world. To be consistent with the MRN model, the dataset included the following sectors: coal, crude oil, electricity, natural gas, refined petroleum products, agriculture, energy-intensive sectors, manufacturing, services, and commercial transportation.

The model is fully dynamic, which means the agents in the model have perfect foresight and therefore perfectly anticipate all future policies. In other words, there are no surprises in the model. MS-MRT belongs to the class of models referred to as general equilibrium.

Conceptually, as a fully dynamic general equilibrium model, the MS-MRT model computes a global equilibrium in which supply and demand are equated simultaneously in all markets for all time periods. The model assumes full employment. There is a representative agent in each region, and goods are indexed by region and time. The incorporated budget constraint implies that there can be no change in any region's net foreign indebtedness over the time horizon of the model. Changes in the prices of internationally traded goods produce changes in the real terms of trade between regions. All markets clear simultaneously, so that agents correctly anticipate all future changes in terms of trade and take them into account in making saving and investment decisions.

The model computes, among other variables, investment, industry output, changes in household welfare, gross domestic product, terms of trade, wage impacts, and commodity price changes. It is fully dynamic, with saving and investment decisions based on full inter-temporal optimization.

In order to capture some of the short-run costs of adjustment, elasticities of substitution between different fuels and between energy and other goods vary with time. The model is benchmarked to assume baseline rates of economic growth based on official government statistics and a common rate of return on capital in all countries. The rate of growth in the effective labor force (population growth plus factor-augmenting technical progress) and the consumption discount rate are calibrated to be consistent both with the assumed rates of growth and return on capital, and with zero capital flows between regions on the balanced growth path. The model is solved in five-year intervals spanning the horizon from 2010 to 2050.

[5] The basic data come from Purdue University's Global Trade Analysis Project (GTAP) and the International Energy Agency (IEA).

The WPT was analyzed under two different assumptions of how the U.S. economy would evolve which correspond to the Energy Information Agency's 2008 International Energy Outlook's (June release) reference and high oil price cases. These forecasts provide the baseline growth rate, energy consumption, energy production, and energy prices to which the model is benchmarked. The International Energy Outlook's forecasts for the U.S. are consistent with the AEO's (2008 June release) forecasts. Therefore, MS-MRT and MRN are benchmarked to the same economic numbers.

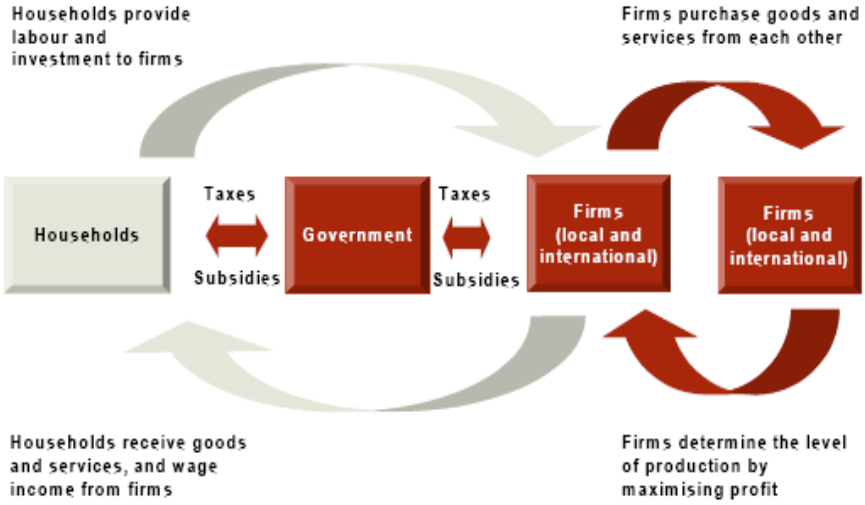
MS-MRT includes the markets for three fossil fuels and their products. Electricity and all other non-energy sectors (e.g., agriculture) are produced using these fuels, capital, labor, and materials as inputs. The model allows for complete bilateral trade in all goods produced by all industries. The MS-MRT model uses an Armington structure in its representation of international trade in all goods except crude oil, which is treated as a homogeneous good perfectly substitutable across regions. The Armington structure assumes that domestically produced goods and imports from every other region are differentiated products. Domestic goods and imports are combined into Armington aggregates, which then function as inputs into production or consumption.

Because crude oil is treated as a homogeneous good, it trades internationally under a single world price. Conversely, representing natural gas and coal as Armington goods allows the model to approximate the effects of infrastructure requirements and high transportation costs between some regions. World supply and demand determine the world price of fossil fuels in the model. Current taxes and subsidies are included in each country's prices.

4.2.2 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 4-2.

Figure 4-2: Circular Flow of Goods and Services and Payment Figure



4.2.3 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, 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.

4.3 INTEGRATION METHODOLOGY

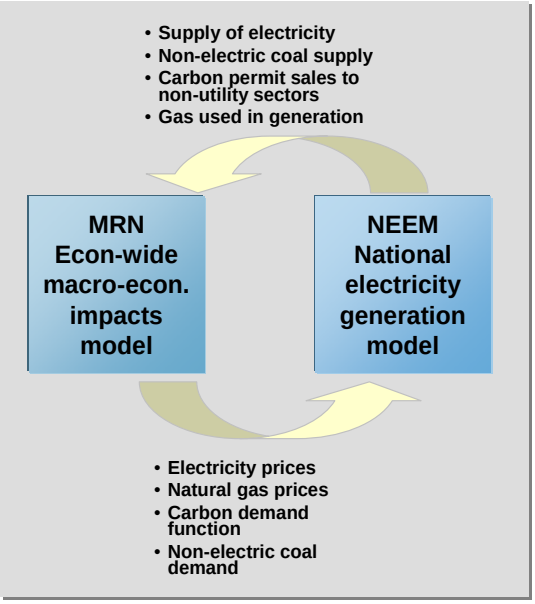
4.3.1 Linking MS-MRT and MRN-NEEM

There is a one-way link between the MS-MRT and MRN-NEEM models. The change in international prices from the U.S. adopting a windfall profits tax becomes an input to MRN-NEEM. This model represents the U.S. and assumes perfectly elastic supply and demand curves for imports and exports. The prices for these curves are determined by MS-MRT.

4.3.2 Linking MRN and NEEM

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 4-3).

Figure 4-3: MRN-NEEM Iterative Process



4.4 STUDY CASE DESCRIPTION

4.4.1 Baselines

In order to assess the range of potential impacts from a windfall profit tax, we analyzed its impact against two baselines with each presenting a decidedly different outlook for the future. We based our baselines on two cases taken from the U.S. Energy Information Administration (EIA), Annual Energy Outlook 2008, June 2008 release. Baseline #1 was based upon the U.S. Energy Information Administration's Annual Energy Outlook 2008, June 2008 release; Reference Case. Baseline #2 was based upon the U.S. Energy Information Administration's Annual Energy Outlook 2008, June 2008 release; High Price Case. Since the impact of a

windfall profits tax will depend highly on the price paths for crude oil, petroleum products and also natural gas, we chose cases that had significantly different price paths. We decided to use EIA's "Reference Case" as a lower bound and their "High Price Case" as the upper bound. EIA's Reference Case represents a moderate view towards future crude oil and natural gas prices. It incorporates a near term decline in world crude oil prices between now and 2016, followed by steady growth in crude oil prices to 2030. By 2030, crude oil prices are projected by EIA to return to a level about 95% of 2010 prices. Natural gas prices are projected by EIA to follow a similar trajectory to that of crude oil. In the near term, they decline from current levels to a low in 2016. After which they steadily increase so that by 2030, prices are forecast by EIA to exceed 2010 levels by about 5%.

In contrast, EIA's High Price Case has world crude oil prices rising steadily from 2010 throughout the model horizon. By 2030, crude oil prices are about 50% more than 2010 prices. As in the Reference Price Case, natural gas prices are forecast by EIA to decline from 2010 levels until 2016, but then prices are forecast to increase more rapidly afterwards to about 115% of 2010 levels by 2030.

As stated earlier, Baseline #1 was based upon the U.S. Energy Information Administration's Annual Energy Outlook 2008, June 2008 release; Reference Case. Baseline #2 was based upon the U.S. Energy Information Administration's Annual Energy Outlook 2008, June 2008 release; High Price Case. To develop Baseline #1, we calibrated the model to the AEO's crude oil price, crude oil production, natural gas prices, natural gas production, oil consumption, and natural gas consumption in the non-electric sectors. Natural gas consumption in the electric sectors is determined endogenously by our electricity sector model, NEEM.

Baseline #2 was derived in a similar manner as Baseline #1 except all the energy quantities and prices were calibrated to the EIA's High Price Case. The overall economic growth rate in each baseline is tied to EIA's forecast GDP growth rate.

4.5 KEY ASSUMPTIONS

4.5.1 Windfall profits tax

The windfall profits tax modeled in this analysis was based upon the language contained in the proposed legislation S.2971. The proposed legislation would impose a windfall profits tax on the adjusted profits of any integrated oil company or any other producer or refiner of crude oil or petroleum products with gross receipts of greater than $1 billion dollars in a taxable year operating in the U.S. The windfall profits tax would be imposed at a rate of 50% on any adjusted taxable income in excess of a reasonable average profit. The adjusted taxable income as defined in the legislation is a company's taxable income increased by interest expense, income deduction, charitable deduction, and any net operating loss deduction carried forward and reduced by any interest income, dividend income and net operating

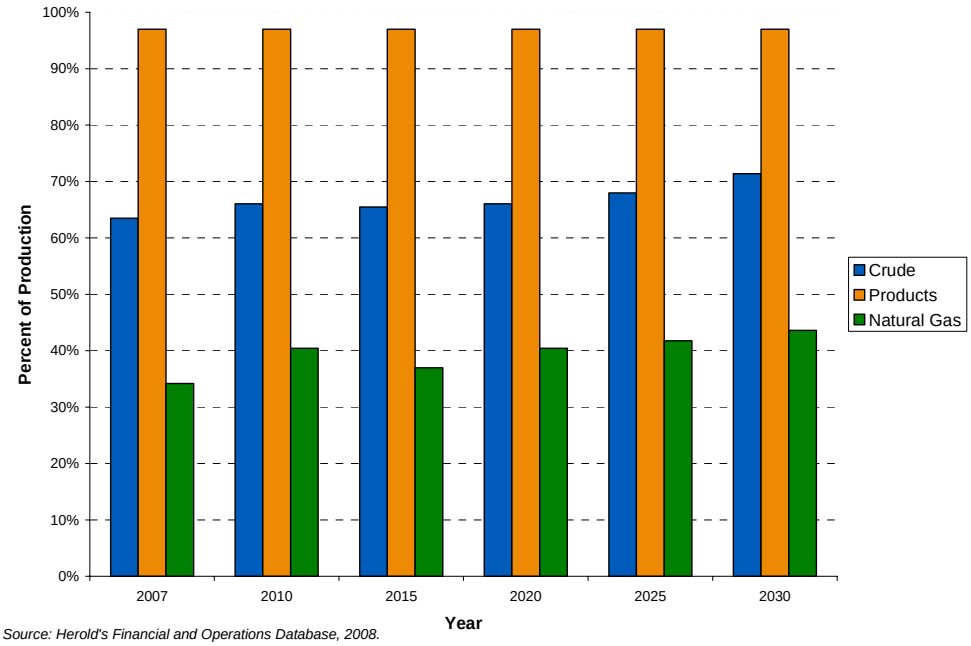
income and net operating income losses to the extent losses exceed taxable income for the taxable year. Reasonable average profit as defined in the legislation is the average profit for years 2000-2004 determined without considering the year with the highest profit plus 10 percent of such average.

4.5.2 Applicable taxpayers

In order to determine those companies potentially impacted by the windfall profits tax we followed the criteria set forth in S.2971. First we assumed all integrated oil companies were subject to the windfall profits tax as stated explicitly in the proposed legislation. For all other companies that were producers or refiners of crude oil or refined oil products, we estimated their future production and gross receipts to determine if they would meet the $1 billion criteria set forth in the proposed legislation. In order to accomplish this, we used the Herold's database which provides historic financial and production history for public and private energy companies. We assessed individual company performance in the year 2007 to determine their production and receipts in 2007. We assumed that they maintained their share of total production throughout the forecast period. We then used the EIA's forecasted crude oil and petroleum product prices in combination with the total production volume forecasts to estimate individual company gross receipts during each year of interest during the forecast period. We did this for both Baseline #1 and Baseline #2. We then determined those companies for each year of the forecast whose gross receipts met the $1 billion criteria called for in the legislation. Armed with this information, we next determined company share of total production in each year. We segmented this for crude oil production and for refining with integrated oil companies included in both segments. In addition, since producers of crude oil often also produce natural gas, we further estimated the share of natural gas production that comes from these same crude oil producers since these investment decisions could also be impacted by a windfall profits tax.

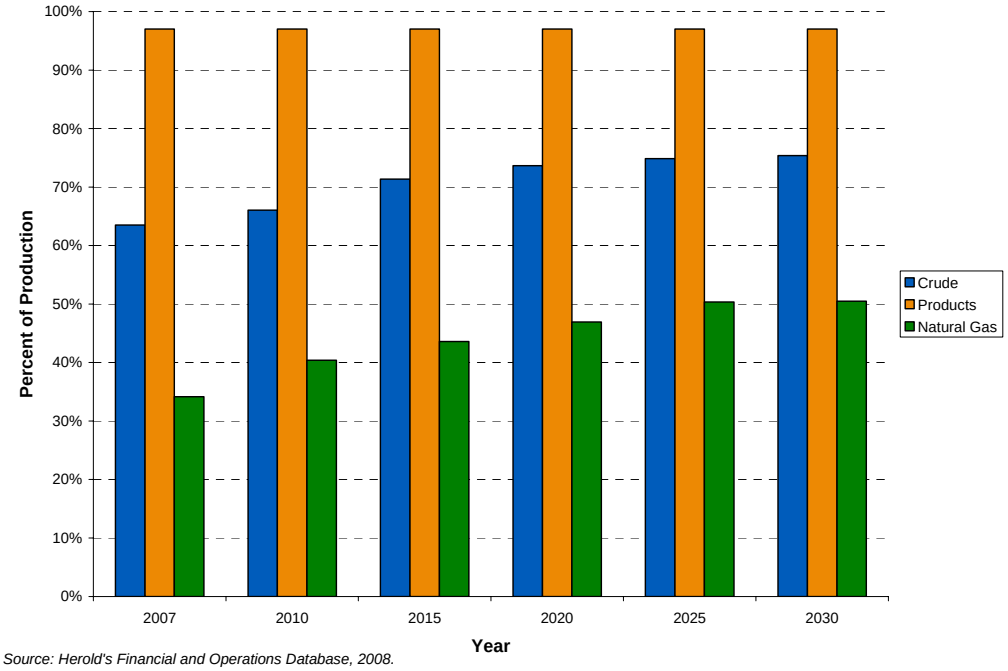
The results of our analysis are shown in Figure 4-4 and Figure 4-5. It is this share of production and future investment that is estimated to be impacted by a windfall profits tax.

Figure 4-4: Estimated Market Share of Crude Oil, Natural Gas, and Petroleum Products Potentially Subject to a Windfall Profits Tax - Baseline #1



Source: Herold's Financial and Operations Database, 2008.

Figure 4-5: Estimated Market Share of Crude Oil, Natural Gas, and Petroleum Products Potentially Subject to a Windfall Profits Tax - Baseline #2



Source: Herold's Financial and Operations Database, 2008.

4.5.3 Marginal investment decisions

Our modeling of the impact of a windfall profits tax took the perspective of the decision making process of the affected company. Once a company has determined that its gross receipts and taxable income subject it to pay a windfall profits tax, then all of its future investment decisions will include in its analysis a windfall profits tax component. Our modeling simulated that decision making process by applying a constant marginal tax rate to capital for all the affected companies. The affected companies were represented by the corresponding share of economy-wide capital employed in the crude oil, natural gas, and refining sectors. Therefore, the windfall profits tax is only applied to the share of capital representing the share of companies affected.

4.5.4 Elasticities

Two critical parameters that have a significant impact on the response of the domestic energy industries to a windfall profits tax are: the Armington elasticity for natural gas and refined products and the resource supply elasticity for energy goods. The Armington elasticity determines how easily imports can replace domestic production should domestic prices increase due to the implementation of a windfall profits tax. To represent the notion that over time natural gas imports will be able to more easily substitute for domestic natural gas as the liquefied natural gas market expands, we increased the Armington elasticity for natural gas over time. Given that products markets are well established, we assume a constant Armington elasticity over time.

The resource supply elasticity of crude oil in MRN is calibrated to be 0.3 in the short run and 1.0 in the long run. The supply elasticity implies an elasticity of substitution between a natural resource and all other goods inputs to be around 0.6 in 2030 (“medium run”) which is consistent with the MIT Emissions Prediction and Policy Analysis (EPPA) Model’s modeling assumptions. Similar to crude oil, we match EPPA’s elasticity of supply for natural gas as well.

4.5.5 Refinery investments

Currently, capital investment in refineries covers the capital needed for expansion and sustaining current operations. In addition, this investment goes toward the purchase of equipment to comply with existing environmental regulations. We assume that these investments to comply with environmental regulations will continue to grow at a rate of 0.5% per year in the future, as regulations are likely to become more stringent. Our model also incorporates the investments that will be required to comply with the biofuel mandates contained in the Energy Independence and Security Act of 2007.

5. BIBLIOGRAPHY

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