Regional Economic Models, Inc.

Economic Impact of Oil and Natural Gas Conservation Policies

Prepared for

U.S. Environmental Protection Agency and the State of Connecticut

By

Regional Economic Models, Inc.

Using

REMI Policy Insight
Single-Region State Model of Connecticut

November 9, 2004

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Executive Summary

The Environment Protection Agency (EPA) contracted Regional Economic Models, Inc. (REMI) to perform an economic assessment of oil and natural gas conservation programs in the State of Connecticut. The focus of the study was on increasing efficiency of oil and natural gas for residential, commercial, and industrial users. The efficiency increase is the result of research and consumer education, and the implementation of energy-efficient equipment by users. Funding for the program is derived from a 3% natural gas-use and oil-use surcharge on residential, commercial, and industrial users.

EPA asked REMI to model the total economic and demographic impacts in Connecticut due to the implementation of conservation policies over a 15-year time horizon from 2005 to 2020. To quantify the indirect and induced effects of the policies, REMI captured all direct effects of the policies, including:

- The oil and natural gas costs increases for residential, commercial, and industrial users resulting from the surcharge on oil and natural gas.
- Savings to residential, commercial, and industrial users due to reduced consumption of natural gas and oil.
- Consumption reallocation of other consumer goods due to an increase in personal income.
- Loss in sales to natural gas and oil firms due to reduced consumption
- Investment in new equipment, construction, research, and other sectors.

REMI examined the above scenarios using a 53-industry-sector, single-region model for the State of Connecticut. Using this model REMI developed an underlying baseline forecast and three alternative forecasts. Two forecasts modeled oil and natural gas as separate policies and the third forecast modeled oil and natural gas in combination. By analyzing the two policies separately and then together, the underlying effects of the individual policies can be seen.

Data for the analysis was provided by: Northeast States for Coordinated Air Use Management (NESCAUM), who provided REMI with projections of total costs and benefits to residential, commercial and industrial users for both oil and natural gas. Data for this analysis was also provided by: Environment Northeast, Institute for Sustainable Energy, Connecticut Department of Public Utility Control, Connecticut Department of Environmental Protection, and the Connecticut Clean Energy Fund, and United Technology Corporation.

Major Findings

Table 1 summarizes the economic growth on the State of Connecticut due to the oil and natural gas conservation policies. This table shows the cumulative growth of Connecticut over the 15-year time period for all three alternative forecasts: oil, natural gas, and the combination of the two[1].

Table 1. Economic Growth Due to Conservation Policies in Connecticut (Cumulative 2005-2020)

	Oil & Natural Gas	Oil	Natural Gas
Employment (Avg Annual Increase)*	2,092	430	1,668
Output (Mil 96$)	3,094.90	82.80	3,020.64
GSP (Mil 96$)	2,033.01	266.21	1,773.82
Population	3,604	717	2,894
Real Disp Pers Inc (Mil 96$)	1,749.42	294.81	1,459.35
State Revenues (Mil 01$)	382.13	66.75	314.97

*Employment is the average annual increase from the baseline. Employment is not cumulative and is based on output growth.

Enacting conservation policies in Connecticut would stimulate positive growth on the economy. It would create roughly 2,092 net new jobs in the Connecticut economy, mostly in the retail and service sectors; and the population would increase by 3,604 people, mostly due to economic migration. By 2020, total Output in Connecticut would grow by $3.10 billion, total GSP would grow by $2.03 billion, and the State of Connecticut would collect approximately $382 million more in State Revenues.

All sectors of the economy will experience strong growth during the time frame, with the exception to the surprisingly small growth in Output. This effect occurs due to a high loss in demand and sales for the petroleum industry in Connecticut (see section 2-1). The strong growth in employment, largely in the service and retail sector, results from the decrease in fuel costs and the increase in Real Disposable Income (the increase in Real Disposable Income directly affects the increase in consumption). Please see section 2 for a detailed description of the results.

As shown in Table 1, the majority of the growth in the Connecticut economy occurs due to the natural-gas conservation policy. The natural-gas conservation policy accounts for roughly 80% of the growth in employment, 98% of the growth in output, 87% of the growth in GSP, 80% of the growth in population, 83% of the growth in Real Disposable Personal Income, and 82% of the growth in State Revenues. The disproportionate ratio between the oil and natural gas policies is due to the higher loss in demand for petroleum than for natural gas. As shown in section 1-3 the loss in demand of oil is almost 6 times higher than the loss in demand for natural gas.

Table 2 and Table 3 show the annual increases in economic growth for two specific years: 2010 and 2020. These graphs are not an accumulation of preceding years, but instead show how much growth Connecticut would experience that year. In the majority of the economic variables; employment,

[1] Please note: the results for the third forecast (oil and natural gas) are from the combination of oil and natural gas **inputs** into REMI Policy Insight, not the combined **outputs** of forecasts 1(oil) and 2(natural gas). Consequently, the results of the third forecast may not be the exact summation of outputs from he first and second forecast.

GSP, population, etc., there is a growth in the annual increase. The one exception is annual Output growth in the oil policy scenario. Between 2010 and 2020 there is a decrease in annual Output growth of $3.91 million. In 2020 there is a decrease in Output from the baseline of that year. However, as shown in section 2-1, only two years in the oil policy scenario experience a decline. The decline in Output for those years is relatively small and is made up in the natural gas scenario.

Table 2. Economic Growth Due to Conservation Policies in Connecticut, 2010

	Oil & Natural Gas	Oil	Natural Gas
Employment	2,076	367	1,708
Output (Mil 96$)	176.10	3.357	172.7
GSP (Mil 96$)	116.90	14.54	102.3
Population	1,604	263.2	1341
Real Disp Pers Inc (Mil 96$)	101.00	15.18	85.82
State Revenues (Mil 01$)	22.52	3.511	19.00

Table 3. Economic Growth Due to Conservation Policies in Connecticut, 2020

	Oil & Natural Gas	Oil	Natural Gas
Employment	2,478	563.7	1913
Output (Mil 96$)	262.80	-0.5493	263.2
GSP (Mil 96$)	170.90	18.62	152.2
Population	3,617	717	2894
Real Disp Pers Inc (Mil 96$)	153.20	27.39	125.9
State Revenues (Mil 01$)	31.62	5.841	25.78

1 Methodology & Assumptions

1-1 REMI Policy Insight

REMI Policy Insight® is the leading regional economic-forecasting and policy-analysis model. For this study, REMI developed Policy Insight for the State of Connecticut. REMI built this model using the REMI model building system, which consists of hundreds of programs developed over the last two decades. The system assembled the State of Connecticut model using data from the Bureau of Economic Analysis, the Bureau of Labor Statistics, the Department of Energy, the Bureau of Census, and other public sources.

REMI Policy Insight is a structural model, meaning that it clearly includes cause-and-effect relationships. The model is based on two key underlying assumptions from mainstream economic theory: households maximize utility and producers maximize profits. Since these assumptions make sense to most people, lay people as well as trained economists can understand the model.

In the model, businesses produce goods to sell to other firms, consumers, investors, governments and purchasers outside the region. The output is produced using labor, capital, fuel, and intermediate inputs. The demand for labor, capital and fuel per unit of output depends on their relative costs, since an increase in the price of any one of these inputs leads to substitution away from that input to other inputs. The supply of labor in the model depends on the number of people in the population and the proportion of those people who participate in the labor force. Economic migration affects the population size. People will move into an area if the real after-tax wage rates or the likelihood of being employed increases in a region.

Supply and demand for labor in the model determines the wage rates. These wage rates, along with other prices and productivity, determine the cost of doing business for every industry in the model. An increase in the cost of doing business causes either an increase in prices or a cut in profits, depending on the market for the product. In either case, an increase in costs would decrease the share of the local and U.S. market supplied by local firms. This market share combined with the demand described above determines the amount of local output. Of course, the model has many other feedbacks. For example, changes in wages and employment impact income and consumption, while economic expansion changes investment and population growth impacts government spending.

Figure 1-1 is a pictorial representation of REMI Policy Insight. The Output block shows a business that sells to all the sectors of final demand as well as to other industries. The Labor and Capital Demand block shows how labor and capital requirements depend both on output and their relative costs. Population and Labor Supply contribute to demand and to wage determination. Economic migrants in turn respond to wages and other labor market conditions. Supply and demand interact in the Wage, Price and Profit block. Prices and profits determine market shares. Output depends on market shares and the components of demand.

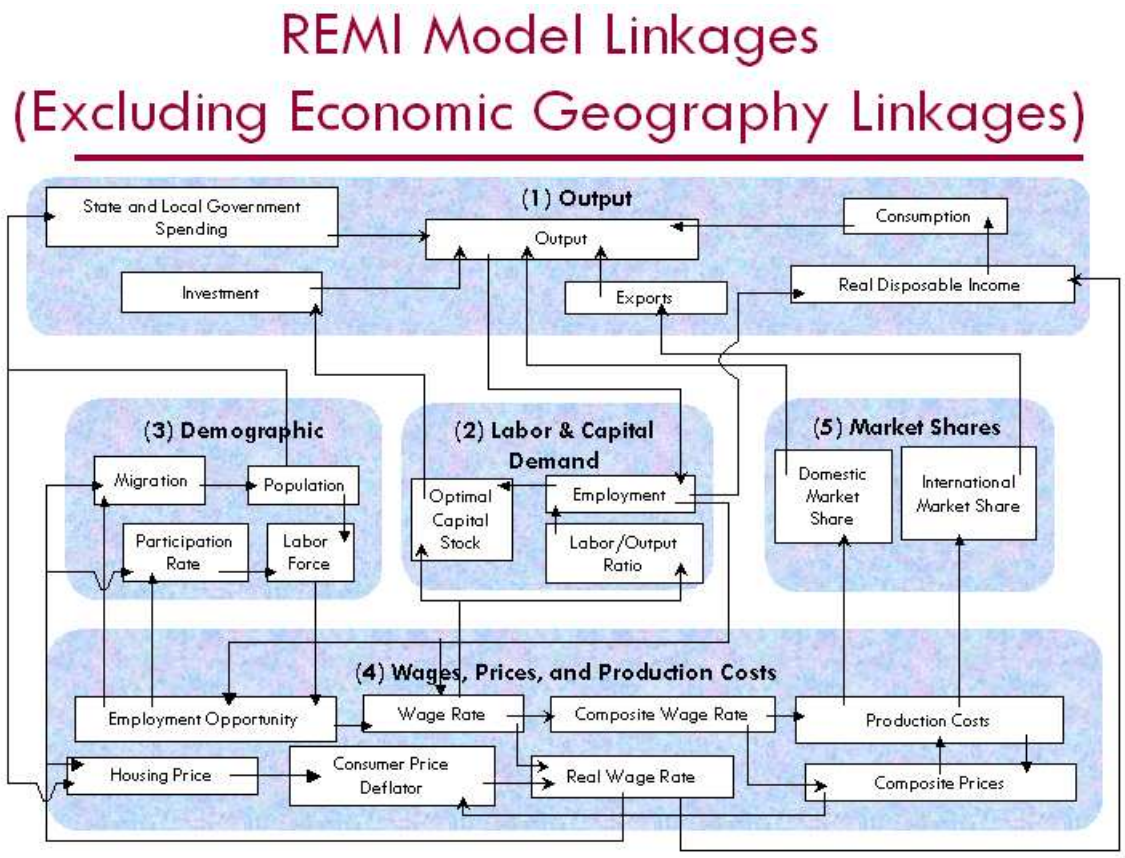

Figure 1. Figure 1-1 REMI Policy Insight overview

The REMI model brings together all of the above elements to determine the value of each of the variables in the model for each year in the baseline forecast. The model includes all the inter-industry interactions that are included in input-output models in the Output block, but goes well beyond an input-output model by including the linkages among all of the other blocks shown in Figure 1-1.

In order to broaden the model in this way, it was necessary to estimate key relationships. This was accomplished by using extensive data sets covering all areas in the country. These large data sets and two decades of research effort have enabled REMI to simultaneously maintain a theoretically sound model structure and build a model based on all the relevant data available.

The model has strong dynamic properties, which means that it forecasts not only what *will* happen but also *when* it will happen. This results in long-term predictions that have general equilibrium properties. This means that the long-term properties of general equilibrium models are preserved while maintaining accurate year-by-year predictions and estimating key equations using primary data sources.

Figure 1-2 shows the policy simulation process for a scenario called Policy X. The effects of a scenario are determined by comparing the baseline REMI forecast with an alternative forecast that incorporates the assumptions for the scenario. The baseline REMI forecast uses recent data and thousands of equations to generate projected economic activity for a particular region. The policy variables in the model are set equal to their baseline value (typically zero for additive variables and

one for multiplicative variables) when solving for the baseline forecast. To show the effects of a given scenario, these policy variables are given values that represent the direct effects of the scenario. The alternative forecast is generated using these policy variable inputs. Figure 1-2 shows how this process would work for a policy change called Policy X.

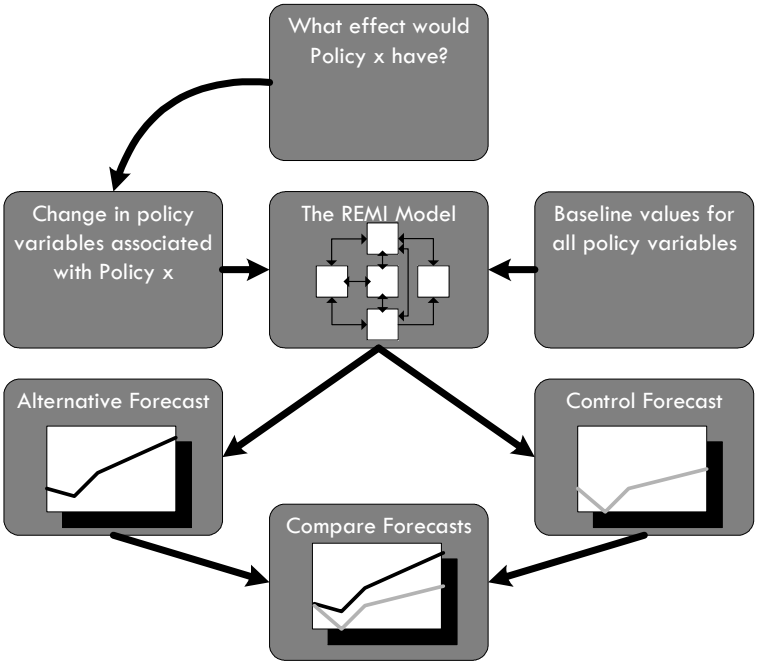

Figure 2. Figure 1-2 Policy X scenario

1-2 Assumptions

For this project, REMI examined the economic effects of oil and natural gas conservation policies in the State of Connecticut. REMI made the following assumptions:

1. The conservation costs and benefits begin in 2005.
2. Increasing the surcharge for both oil and natural gas decreases consumer spending for other consumer goods.
3. When efficiency increases, consumers and commercial and industrial firms require less oil and natural gas.
4. Any drop in consumer spending on oil and natural gas is reallocated to increased spending on other goods.
5. Decreasing costs for both commercial and industrial firms reduces production costs.
6. All output sold by oil and natural gas industries is considered intermediate goods.
7. The benefits of enacting the oil and natural gas policies are seen in the first year (no time lag).

1-3 Simulation Inputs

For simulation inputs please see Tables 1-1 and 1-2. The first two forecasts modeled oil and natural gas as separate policies. The third forecast combined Tables 1-1 and 1-2 to model the economic effects of both policies on Connecticut.

Consumer Spending

For both energy types, oil and natural gas, there was both a decrease and increase in consumer spending. The increase in consumer spending is due to the surcharge on oil and natural gas. The surcharge boosts the cost of a relatively inelastic good, which forces consumers to purchase less of other goods to pay for the increase in energy prices. They save money, however, as a result of the efficiency improvements they are able to implement due to the program. The decrease in consumer spending is the benefit that residential users will receive from requiring less energy to fuel their homes. Shown in 'Consumer Spending' Tables 1-1 and 1-2

Consumption Reallocation

Consumption reallocation transfers the money saved on energy to purchasing other goods. The input is based on the assumption that all money saved from energy efficient improvements will be spent on other goods. Shown in 'Consumption Reallocation' on Tables 1-1 and Tables 1-2.

Energy Costs

All of REMI's forecasts indicate that energy costs increase for industrial and commercial users due to the surcharge, but decrease due to more efficient energy usage. Oil and Natural Gas are modeled similarly. In both forecasts fuel costs for firms rise due to the surcharge, but the firms also save money as a results of the improvements they implement due to the program. Shown in 'Oil Cost for

Commercial Firms' and 'Oil Cost for Industrial Firms' in Table 1-1 for oil, and as shown in 'NG cost for Commercial Firms' and 'NG Cost for Industrial Firms' in Table 1-2 for natural gas.

Intermediate Demand

Both the oil and natural gas industry sectors experience a loss in revenue due to the decrease in demand spurred by conservation policies. This loss is entered into REMI Policy Insight as a loss of intermediate demand for the particular industry. The intermediate demand variable in REMI Policy Insight does take into account that local firms will not absorb 100% of the loss in demand. How much demand loss is 'transferred' to firms outside the region depends on the Regional Purchase Coefficient (RPC). Each industry in REMI Policy Insight has a specific RPC. The RPC is the ratio of consumer goods bought from local firm versus non-local firms. Please note that the loss in intermediate demand is much greater on the oil industry than on the natural gas industry. Shown in 'Intermediate Demand' on Tables 1-1 and 1-2.

Investment

REMI modeled significant investment in electrical equipment and other sectors through increased industry demand. Since there are no estimated investment values, we approximate the investment in different sectors using REMI Policy Insight forecast data. Doing so yields total output by industry, which, when multiplied by the ratio of electricity to total output in the I-O table, gives an estimation of the total annual spending on electricity. Dividing by the adjusted REMI baseline prices (as given by the IPM run), we get an estimate of annual MWh consumption. Now we can multiply by the surcharge of $3/MWh, which gives us an estimate of the total funds generated for investment in energy efficiency. This investment is allocated to several different sectors using percentages determined from 2001, 2002, and 2003 ECMB budget figures, as shown:

49%	Electrical Equipment	(2907: Industry Sales (amount) Electrical Equipment),
13%	Construction	(2923: Industry Sales (amount) Construction),
13%	Professional Services	(2946: Industry Sales (amount) Miscellaneous Professional Services),
7%	Business Services	(2942: Industry Sales (amount) Miscellaneous Business Services)
6%	Government Spending	(181: Government Spending (amount) State),
5%	Education	(2947: Industry Sales (amount) Education),
5%	Public Utilities	(1830: Capital Costs (amount) Public Utilities),

For the purpose of fitting the table into the report all investment was combined in 'Investment Spending' on Tables 1-1 and 1-2. The investment categories were not combined in REMI Policy Insight, but broken down by the above percentages.

Oil Simulation Inputs

Table 1-1 Data Inputs for Oil (96 Mil $)

	2005	2006	2007	2008	2009	2010
Consumer Spending on Oil	-9.51	-18.53	-27.17	-35.85	-44.24	-51.93
Consumer Spending on Oil	34.03	33.16	32.18	31.66	30.82	29.85
Consumption Reallocation	9.51	18.53	27.17	35.85	44.24	51.93
Consumption Reallocation	-34.03	-33.16	-32.18	-31.66	-30.82	-29.85
Oil Cost for Commercial Firms	-2.22	-8.51	-12.33	-15.39	-17.79	-19.30
Oil Cost for Commercial Firms	6.38	6.12	5.85	5.66	5.48	5.28
Oil Cost for Industrial Firms	-0.31	-1.20	-1.72	-2.02	-2.23	-2.37
Oil Cost for Industrial Firms	0.70	0.66	0.62	0.59	0.57	0.56
Intermediate Demand for Oil	-25.48	-98.92	-123.33	-133.79	-137.39	-138.51
Investment Spending	40.30	39.14	37.88	37.16	36.14	34.98

	2011	2012	2013	2014	2015	2016
Consumer Spending on Oil	-60.02	-68.05	-76.60	-84.75	-91.45	-97.27
Consumer Spending on Oil	29.29	28.83	28.39	27.88	27.40	27.12
Consumption Reallocation	60.02	68.05	76.60	84.75	91.45	97.27
Consumption Reallocation	-29.29	-28.83	-28.39	-27.88	-27.40	-27.12
Oil Cost for Commercial Firms	-20.73	-22.06	-23.51	-24.74	-25.94	-27.15
Oil Cost for Commercial Firms	5.21	5.17	5.17	5.14	5.13	5.12
Oil Cost for Industrial Firms	-2.54	-2.69	-2.87	-3.02	-3.17	-3.32
Oil Cost for Industrial Firms	0.56	0.56	0.57	0.58	0.58	0.58
Intermediate Demand for Oil	-142.09	-144.76	-150.98	-154.55	-152.60	-157.56
Investment Spending	34.36	33.87	33.45	32.92	32.45	32.17

	2017	2018	2019	2020	Total
Consumer Spending on Oil	-101.87	-107.51	-111.91	-115.99	-1102.65
Consumer Spending on Oil	26.63	26.51	26.20	26.01	465.95
Consumption Reallocation	101.87	107.51	111.91	115.99	1102.65
Consumption Reallocation	-26.63	-26.51	-26.20	-26.01	-465.95
Oil Cost for Commercial Firms	-28.18	-29.54	-30.61	-31.67	-339.67
Oil Cost for Commercial Firms	5.09	5.12	5.11	5.10	86.13
Oil Cost for Industrial Firms	-3.44	-3.61	-3.74	-3.88	-42.12
Oil Cost for Industrial Firms	0.59	0.59	0.59	0.60	9.53
Intermediate Demand for Oil	-160.47	-162.85	-166.41	-171.89	-2221.57
Investment Spending	31.67	31.58	31.26	31.07	550.37

Natural Gas Simulation Inputs

Table 1-2 Data Inputs for Oil (96 Mil $)

	2005	2006	2007	2008	2009	2010
Consumer Spending on NG	-32.60	-63.33	-78.85	-85.39	-87.90	-89.05
Consumer Spending on NG	27.76	25.71	23.88	22.13	20.63	19.43
Consumption Reallocation	32.60	63.33	78.85	85.39	87.90	89.05
Consumption Reallocation	-27.76	-25.71	-23.88	-22.13	-20.63	-19.43
NG Cost for Commercial Firms	-18.09	-70.29	-87.51	-94.77	-97.55	-98.83
NG Cost for Commercial Firms	30.81	28.54	26.50	24.56	22.90	21.56
NG Cost for Industrial Firms	-7.39	-28.62	-35.82	-39.02	-39.84	-39.69
NG Cost for Industrial Firms	13.03	11.96	11.19	10.29	9.44	8.80
Intermediate Demand for NG	-2.53	-9.71	-14.05	-17.41	-20.02	-21.67
Investment Spending	70.18	64.88	60.34	55.84	51.91	48.80

	2011	2012	2013	2014	2015	2016
Consumer Spending on NG	-91.63	-93.63	-97.56	-99.95	-99.24	-102.34
Consumer Spending on NG	18.84	18.25	18.11	17.77	16.97	16.95
Consumption Reallocation	91.63	93.63	97.56	99.95	99.24	102.34
Consumption Reallocation	-18.84	-18.25	-18.11	-17.77	-16.97	-16.95
NG Cost for Commercial Firms	-101.69	-103.92	-108.28	-110.93	-110.14	-113.58
NG Cost for Commercial Firms	20.91	20.26	20.10	19.72	18.84	18.82
NG Cost for Industrial Firms	-40.40	-40.84	-42.70	-43.62	-42.45	-43.99
NG Cost for Industrial Firms	8.52	8.17	8.18	8.01	7.51	7.58
Intermediate Demand for NG	-23.26	-24.75	-26.38	-27.75	-29.11	-30.47
Investment Spending	47.30	45.75	45.47	44.59	42.45	42.48

	2017	2018	2019	2020	Total
Consumer Spending on NG	-104.28	-105.96	-108.31	-111.71	-1451.73
Consumer Spending on NG	16.81	16.69	16.71	16.91	313.58
Consumption Reallocation	104.28	105.96	108.31	111.71	1451.73
Consumption Reallocation	-16.81	-16.69	-16.71	-16.91	-313.58
NG Cost for Commercial Firms	-115.73	-117.60	-120.20	-123.98	-1593.10
NG Cost for Commercial Firms	18.66	18.52	18.55	18.77	348.02
NG Cost for Industrial Firms	-44.73	-45.25	-46.21	-47.91	-628.48
NG Cost for Industrial Firms	7.56	7.52	7.56	7.71	143.02
Intermediate Demand for NG	-31.63	-33.15	-34.35	-35.55	-381.79
Investment Spending	42.17	41.87	41.97	42.52	788.52

2 Results & Analysis

As shown in Table 2-1, enacting conservation policies in Connecticut will stimulate positive growth on the economy. All sectors of the economy will experience strong growth during the time frame, with the exception of surprisingly small growth in Output. This effect occurs due to a loss in demand and sales for the petroleum industry in Connecticut (see section 2-1). Connecticut does experience strong growth in employment, largely in the service and retail sector, resulting from the decrease in fuel costs and increase in Real Disposable Income (the increase in Real Disposable Income directly affects the increase in consumption).

Table 2-1 Major Economic Growth in Connecticut Due to Conservation Policies, Annual

	2005	2006	2007	2008	2009	2010
Employment	1,073	1,441	1,674	1,848	1,975	2,076
Output (Mil 96$)	107.10	116.20	130.30	146.60	161.70	176.10
GSP (Mil 96$)	64.96	76.84	87.65	98.45	108.00	116.90
Population	161	426	722	1,023	1,320	1,604
Real Disp Inc (Mil 96$)	29.17	57.75	73.29	84.86	93.59	101.00
State Revenues (Mil 01$)	8.37	13.79	16.87	19.22	20.99	22.52

	2011	2012	2013	2014	2015	2016
Employment	2,156	2,215	2,296	2,346	2,343	2,385
Output (Mil 96$)	187.60	197.20	208.10	216.90	222.70	231.20
GSP (Mil 96$)	124.40	130.50	137.60	143.10	146.40	151.80
Population	1,875	2,129	2,373	2,602	2,805	2,996
Real Disp Inc (Mil 96$)	107.60	113.30	120.40	126.10	128.80	134.40
State Revenues (Mil 01$)	23.79	24.84	26.19	27.20	27.62	28.58

	2017	2018	2019	2020
Employment	2,406	2,427	2,446	2,478
Output (Mil 96$)	239.00	246.60	254.20	262.80
GSP (Mil 96$)	156.60	161.10	165.60	170.90
Population	3,171	3,332	3,479	3,617
Real Disp Pers (Mil 96$)	138.90	143.20	147.80	153.20
State Revenues (Mil 01$)	29.32	30.01	30.73	31.62

2-1 Output

The Output of an economy is the amount of production in dollars, including all intermediate goods purchased as well as value-added (labor, capital, and fuel investments and profit). We can also think of output as sales for both final goods and intermediate goods. Output is dependent upon consumption in the area, state government spending, investment, and exports of the industries in the region.

In both of these scenarios state government spending, investment, and industry sales remain relatively equal between the two scenarios. The difference in output is based on the decrease in consumption that results from higher costs for consumers.

When looking at Output growth in the oil and natural gas policy scenarios separately, we see that the majority of growth results from the natural gas. Very little growth in output for Connecticut occurs due to the oil policy. In fact, a loss of Output from the baseline occurs in 2014 and 2020. The significant difference in Output growth is due to a loss in demand for oil (please refer to Table 1-1; Intermediate Demand for Oil). By 2020, the oil industry will receive a total loss of demand of $2.221 billion, compared to the natural gas industry which will experience of loss in demand of $340 million. The REMI simulation does take into account economic leakage, that is, the loss of demand does not fully occur in the State of Connecticut.

In the first forecast (oil as a single policy) the petroleum-products industry receives a cumulative loss of $451 million over the forecast period. In the second forecast (natural gas as a single policy) the natural gas industry has a cumulative loss of $10.5 million over the forecast period. Again, this is due the higher loss in intermediate demand for the oil industry.

The projected increase in output in 2005 is $107.1 million when looking at the oil and natural gas policies combined. By 2020 the Output growth of both policies is $262 million dollars with a cumulative total of $3.1 billion.

Figure 3. Figure 2-1 Increase in Output (Mil 96 $)

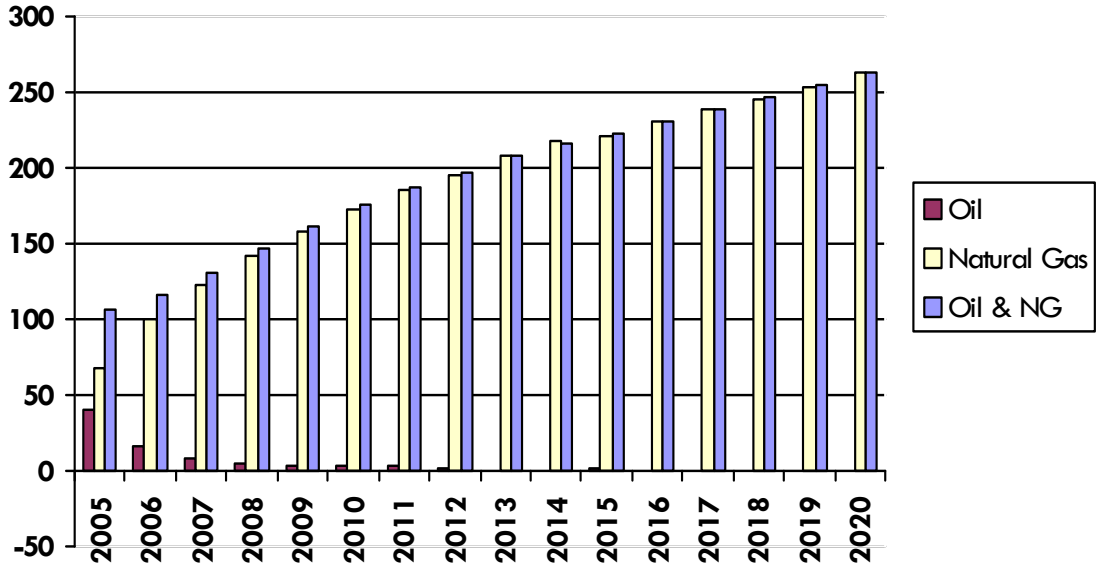

Table 2-2 Annual increase in Output (Mil 96 $)

	2005	2006	2007	2008	2009	2010	2011	2012	2013
Oil	39.93	16.62	7.904	4.654	3.494	3.357	2.472	2.106	0.6104
Natural Gas	67.09	99.55	122.4	142	158.2	172.7	185.2	195.1	207.5
Oil & NG	107.10	116.20	130.30	146.60	161.70	176.10	187.60	197.20	208.10

	2014	2015	2016	2017	2018	2019	2020	Total
Oil	-0.4578	1.099	0.3967	0.1831	0.6409	0.3357	-0.5493	82.7957
Natural Gas	217.2	221.5	230.8	238.7	245.8	253.7	263.2	3,020.64
Oil & NG	216.90	222.70	231.20	239.00	246.60	254.20	262.80	3,104.30

2-2 Gross State Product

Gross State Product (GSP) as a value added concept is analogous to the national concept of Gross Domestic Product. It is equal to Output, excluding intermediate inputs. The value-add concept is equal to compensation and profits.

Similar to Output, GSP growth in the oil-policy scenario is significantly lower than natural gas. However, in the oil-policy scenario, GSP does not experience any of the loss that Output does due to the definition of GSP. The Output of an economy is the sales of all goods, including intermediate and final goods. GSP does not include sales of intermediate goods, and all demand loss for oil by firms is intermediate. As seen in Figure 2-3, in the natural-gas-policy scenario GSP increases dramatically over the 15-year time horizon, while there is only a slight increase in GSP in the oil-policy scenario.

The projected increase in GSP in 2005 is $64.96 million. By 2020 the annual increase for GSP is $170.90 million with a cumulative increase of $2,040.80 million.

Figure 4. Figure 2-2 Annual increase in Gross State Product (Mil 96 $)

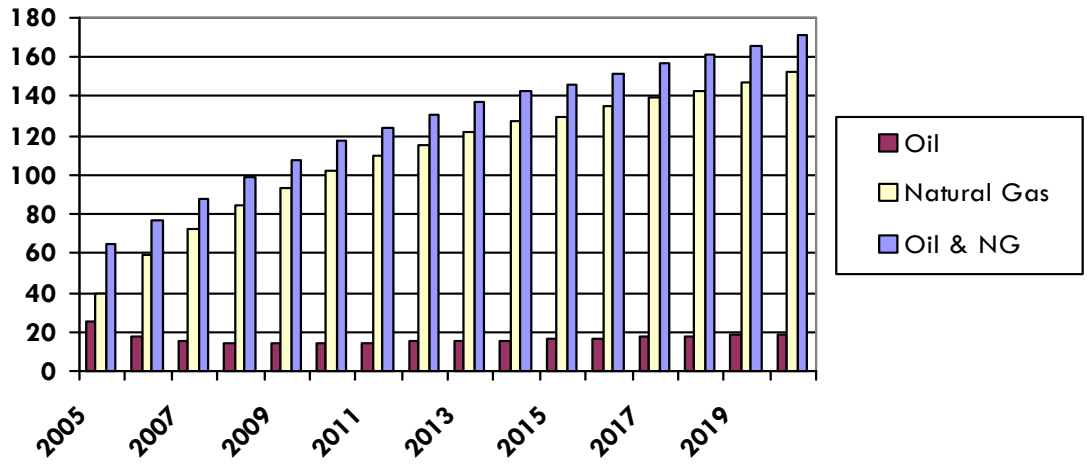

Table 2-3 Annual increase in Gross State Product (Mil 96 $)

	2005	2006	2007	2008	2009	2010	2011	2012	2013
Oil	24.95	17.62	14.94	14.24	14.25	14.54	14.79	15.17	15.27
Natural Gas	39.98	59.2	72.71	84.2	93.73	102.3	109.6	115.3	122.3
Oil & NG	64.96	76.84	87.65	98.45	108.00	116.90	124.40	130.50	137.60

	2014	2015	2016	2017	2018	2019	2020	Total
Oil	15.35	16.31	16.69	17.17	17.96	18.34	18.62	266.21
Natural Gas	127.7	130	135	139.3	143.1	147.2	152.2	1773.82
Oil & NG	143.10	146.40	151.80	156.60	161.10	165.60	170.90	2,040.80

2-3 Employment

The Employment variable in REMI Policy Insight uses historical data from the Bureau of Economic Analysis (BEA) and is based upon place of work, including part-time and full-time employees. The employment figures projected below are the difference from baseline and should not be cumulated.

As expected, the increase in employment is largely due to the natural gas policy. However, there is also an employment increase due to the oil policy, roughly 33% of the total in 2005 and 20% of the total employment increase in 2020. The employment increase in both scenarios is due largely to increases in consumption (an increase in consumption is the result of an increase in consumer spending). Consequently, roughly 66% percent (1,650 jobs) of new employment is in the retail trade and service sectors in 2020. The two industries that suffer a loss in employment are the petroleum products industry (16 workers by 2020) and the natural gas industry (4 workers by 2020). Fortunately the employment losses are so small that they can be considered negligible. There is also some indirect job loss in the oil-policy scenario due to oil firms purchasing slightly less capital from the decrease in demand. Again, the employment loss is relatively small, only 10 jobs in 2020, and the loss is made up in the employment gains from consumption.

The initial total employment increase in 2005 is 1,073 net new workers. The initial growth rate is high, roughly 34%, but slows considerably over the next 14 years, to 1% in 2020. The decreasing growth rate flattens the growth in employment as the economy adjusts. By 2020 the total net new employment is 2,478 new workers.

Figure 5. Figure 2-3 Increase in Employment from baseline, annual

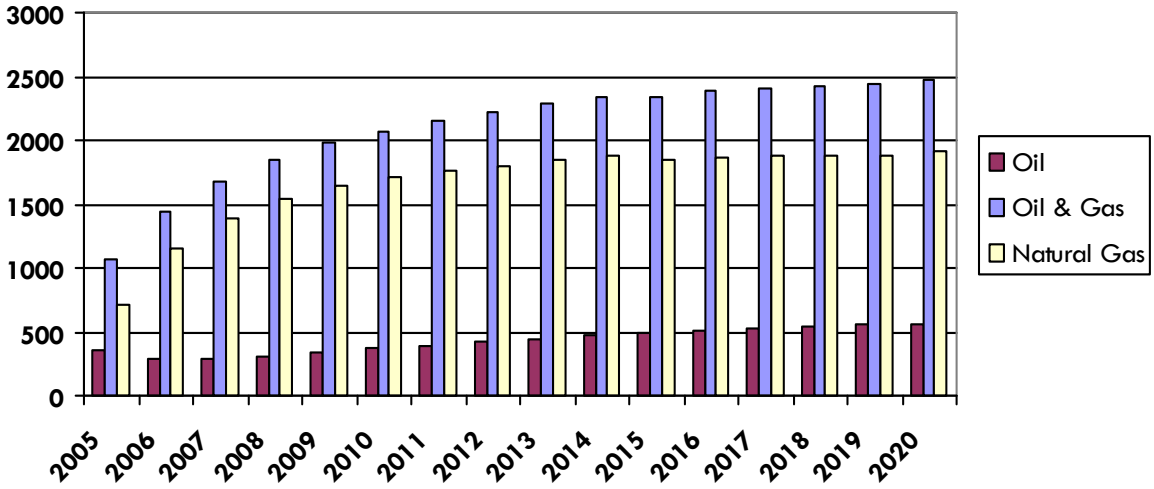

Table 2-4 Increase in Employment from baseline, annual

	2005	2006	2007	2008	2009	2010	2011	2012
Oil	356	293	287	309	338	367	393	421
Natural Gas	716	1,149	1,386	1,539	1,637	1,708	1,762	1,793
Oil & NG	1,073	1,441	1,674	1,848	1,975	2,076	2,156	2,215

	2013	2014	2015	2016	2017	2018	2019	2020
Oil	447	470	497	513	526	545	556	564
Natural Gas	1,849	1,875	1,845	1,870	1,878	1,880	1,889	1,913
Oil & NG	2,296	2,346	2,343	2,385	2,406	2,427	2,446	2,478

2-4 Population

Population is a key variable in REMI Policy Insight that affects the potential labor force, government spending, consumption spending, and housing prices. The changes in population are due to changes in migration, the result of either economic growth or loss.

All changes in population are cumulative. Each year is difference from baseline, but includes the previous year. The large increase in population is due to the natural gas investment. In 2005 the population of the State of Connecticut increases by 161 people with a linear increase cumulating to 3,617 net new people in Connecticut in 2020. The in migration is due largely to economic migration and the family members of the economic migrants.

Figure 6. Figure 2-4 Increase in Population from baseline, cumulative

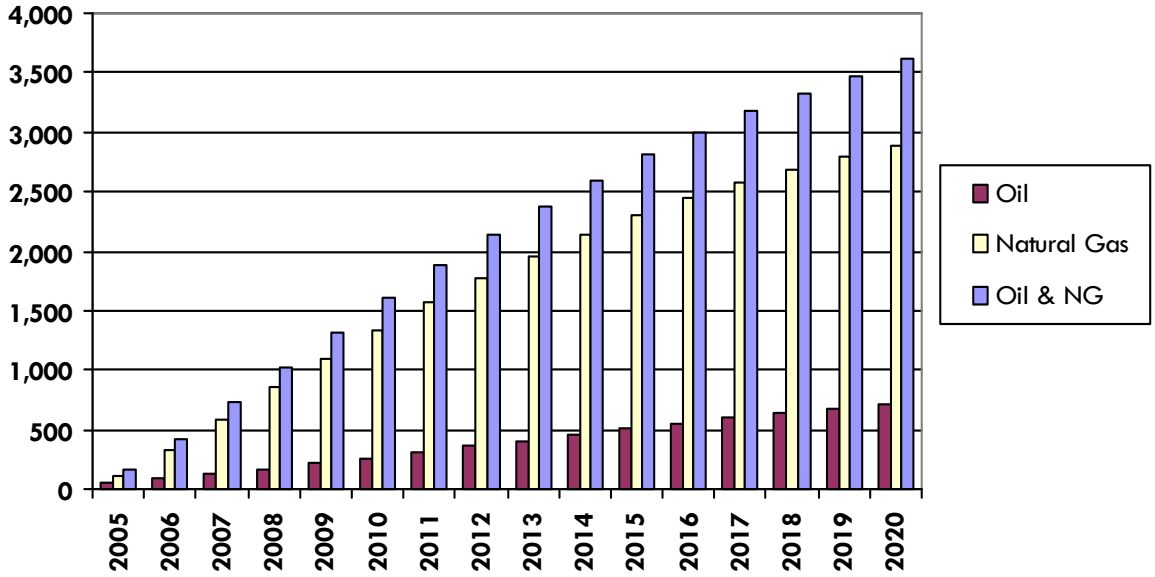

Table 2-5 Increase in Population from baseline, cumulative

	2005	2006	2007	2008	2009	2010	2011	2012
Oil	53	92	131	173	217	263	310	358
Natural Gas	108	334	590	851	1,102	1,341	1,563	1,768
Oil & NG	161	426	722	1,023	1,320	1,604	1,875	2,129

	2013	2014	2015	2016	2017	2018	2019	2020
Oil	407	455	503	550	595	638	680	717
Natural Gas	1,963	2,143	2,296	2,440	2,572	2,688	2,794	2,894
Oil & NG	2,373	2,602	2,805	2,996	3,171	3,332	3,479	3,617

2-5 Real Disposable Income

Real Disposable Income is the inflation-adjusted income that is available for consumers to spend. It is personal income minus taxes and social contributions plus dividends, rents, and transfer payments. The numbers of employees in the area, their wage rate, and the consumer prices all affect real Disposable Income. An increase in employment or wage, or a decrease in consumers' prices increases a region's Real Disposable Income. Consequently, the opposite decreases Real Disposable Income.

The increase in Real Disposable Income is an indirect effect from the new jobs in Connecticut. The summation of new wages, minus taxes, earned by workers equals the increase in Real Disposable Income. Although there was a decrease in the amount of spending on natural gas and oil, there was no direct effect on Real Disposable Income as it was assumed any decrease in spending on natural gas and oil would be spent on other goods.

The projected increase in Real Disposable Income is $29.17 million in 2005. By 2020, Real Disposable Income increases to $153.20 million for a cumulative increase of $1753.36 million.

Figure 7. Figure 2-5 Increase in Real Disposable Income (Mil 96 $)

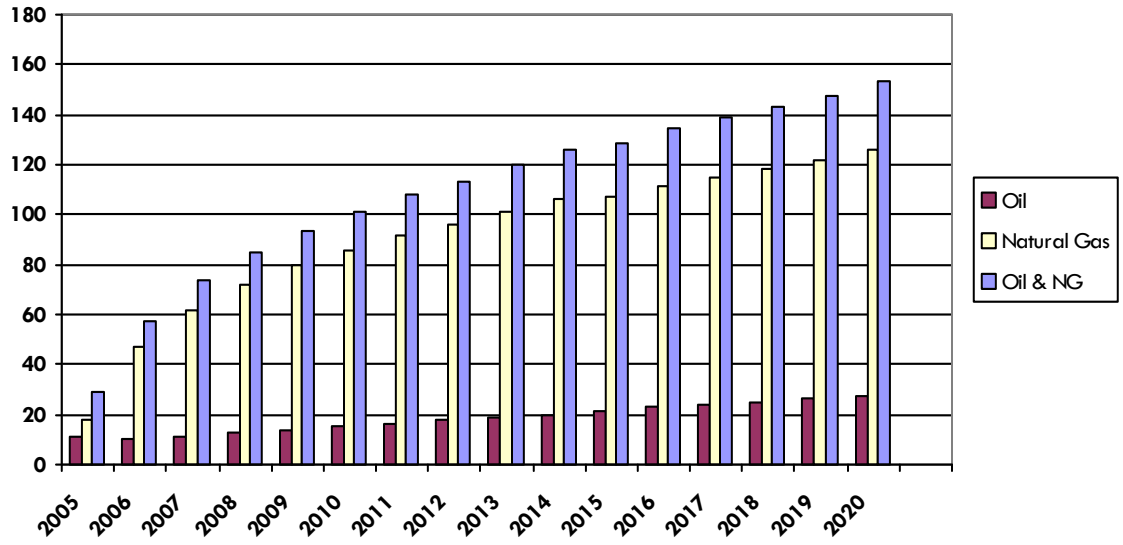

Table 2-6 Annual increase in Real Disposable Income (Mil 96 $)

	2005	2006	2007	2008	2009	2010	2011	2012	2013
Oil	11.3	10.53	11.18	12.49	13.85	15.18	16.37	17.64	18.91
Natural Gas	17.87	47.22	62.13	72.4	79.74	85.82	91.38	95.69	101.5
Oil & NG	29.17	57.75	73.29	84.86	93.59	101.00	107.60	113.30	120.40

	2014	2015	2016	2017	2018	2019	2020	Total
Oil	20.08	21.59	22.78	23.9	25.27	26.35	27.39	294.81
Natural Gas	105.9	107.3	111.8	115.2	118.1	121.4	125.9	1459.35
Oil & NG	126.10	128.80	134.40	138.90	143.20	147.80	153.20	1,753.36

2-6 State Revenue

State Revenue represents the gains or losses in income for the State of Connecticut from tax revenues. These revenues include individual income tax, general sales tax, tobacco sales tax, and property tax. All changes in state revenue are indirect effects only. It does not take into account the changes in tax income from the oil and natural gas industry. All effects are the results of a change in economic activity. Real Disposable Income and Population affect State Revenues directly.

As seen in section 2-5 the large increase in Real Disposable Income is the due to the natural gas policy. As Population and Real Disposable Income increases, so do the State Revenues that Connecticut collects. Beginning in 2005 the State of Connecticut will collect $8.37 million additional revenue due to the conservation policies. In 2020, the State of Connecticut will collect $31.62 million cumulating to a total of $381.66 million collected over the 15 year time period.

Figure 8. Table 2-6 Annual increase in State Revenue (Mil 01 $)

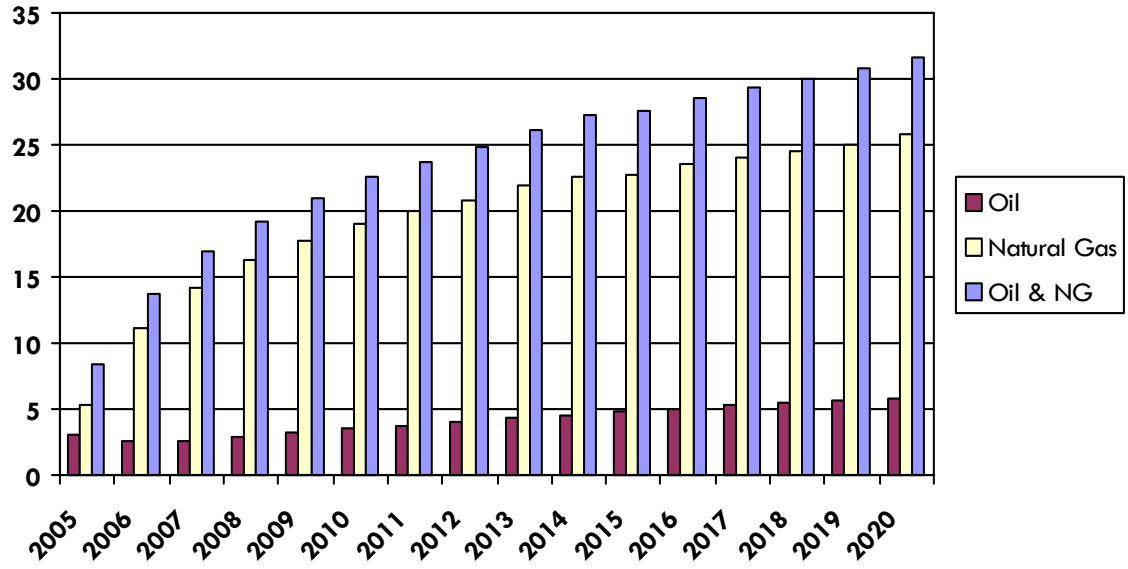

Table 2-7 Annual increase in State Revenue (Mil 01 $)

	2005	2006	2007	2008	2009	2010	2011	2012	2013
Oil	3.01	2.61	2.66	2.91	3.21	3.51	3.77	4.04	4.30
Natural Gas	5.36	11.18	14.22	16.31	17.78	19.00	20.04	20.80	21.89
Oil & NG	8.37	13.79	16.87	19.22	20.99	22.52	23.79	24.84	26.19

	2014	2015	2016	2017	2018	2019	2020	Total
Oil	4.54	4.85	5.06	5.26	5.51	5.69	5.84	66.75
Natural Gas	22.65	22.78	23.53	24.08	24.52	25.05	25.78	314.97
Oil & NG	27.20	27.62	28.58	29.32	30.01	30.73	31.62	381.66

Appendix: Economic Impact of Health Benefits using COBRA

Using additional data provided by EPA, REMI ran two additional forecast scenarios modeling the economic effect of the increase in health benefits due to the conservation programs. The health benefits are the result of the conservation policies indirectly reducing air pollution. To estimate the overall economic impact of the reduction in air pollution, REMI used outputs from EPA's Co-benefits Risk Assessment (COBRA) model. COBRA provides of monetary value of the changes in health benefits due to changes in air pollution.

COBRA

The COBRA model calculates the monetary impact of changes in air pollution via a three-step process. First, the COBRA model uses an air-quality model to quantify the associated change in air particles. Second, COBRA uses concentration response (C-R) functions that link changes in particles to health incidences, such as a decrease in respiratory illnesses due to less harmful particulate matter in the air. Finally, COBRA estimates the monetary impact of each health incidence based on direct medical costs, value of statistical life, willingness-to-pay, and cost-of-illness values.

Compensating Differential

Model Inputs

Mortality Change

To simulate the mortality change, the number of deaths decreased from the COBRA model was used to change the survival rate of the simulation. The 2010 and 2020 COBRA snapshots provided two points of the actual numbers of deaths avoided if the policy was implemented. The years between 2005-2009 and 2009-2020 were interpolated linearly from those two points.

Health Incidence Improvements

The total dollar value of the health improvements from the Cobra model was used to change the compensating differential within the simulation. The lowered compensating differential decreases the amount of wage needed to keep or attract new employees into the region due to better air quality.

Medical and Insurance Impacts

The final values the COBRA model provided was the loss of business activity for the medical and insurance industries. Due to healthier Connecticut residences from the policy impact, there will be a decrease in demand for the Connecticut's medical and health insurance sectors. The value used was the same as the total dollar value of the health improvements. The assumption used to estimate loss in revenue due fewer health incidences put 50% of loss in the medical industry and 50% in the insurance industry. The policy variables used in Policy Insight was a decrease in demand for both these industries.

Results

Table 4 summarizes the economic growth on the State of Connecticut due to the increase in health benefits of the oil and natural gas conservation policies. This table shows the cumulative growth of Connecticut over the 15-year time period for three alternative forecasts. The first forecast simulates the economic impact of the health benefits only without using REMI Policy Insight's Compensating Differential Variable (See Inputs). The second forecast simulates the economic impact of the health benefits only with using REMI Policy Insight's Compensating Differential variable. The final forecast included all inputs of the oil and natural gas policies and the inputs calculated from COBRA.

Table 4. Economic Growth Due to Conservation Policies in Connecticut (Cumulative 2005-2020)

	Health Benefits without Comp Diff	Health Benefits with Comp Diff	Oil & Natural Gas with COBRA
Employment (Avg Annual Increase)*	-15	-9	1,670
Output (Mil 96$)	-22.57	-11.00	3,094.00
GSP (Mil 96$)	-12.36	-3.98	2,037.14
Population	2	41	1,724
Real Disp Pers Inc (Mil 96$)	-5.75	3.30	1,758.13
State Revenues (Mil 01$)	-1.26	0.81	382.74

Using EPA's COBRA model, REMI was able to model the economic impacts of the increase in air quality in Connecticut due to the energy conservation projects. The results of the REMI model show a small negative effect upon the economy. The negative effect is due to the loss in revenue for the medical and insurance industry. Even though the Connecticut benefits economically from an increase in labor productivity and the compensating differential, the benefits do not outweigh the loss in revenue for the medical and insurance industry[2].

In the first forecast shows a decrease in 15 jobs in the economy, a loss of $22.57 million in Output and $12.36 million in GSP by 2020. Real Disposable Income decreases by $5.75 million and the State of Connecticut losses $1.26 million in State Revenue. The only positive increase in the first forecast is Population by 2 people.

The second forecast has the negative impacts are slightly dampened due the inclusion of the Compensating Differential variable. The second forecast shows a loss in employment of 9 jobs, a loss of $11 million in Output and $3.98 million in GSP. By using the compensating differential variable there are slightly positive impacts for Population, Real Disposable Income, and State Revenues. As stated in the inputs section, compensating differential increases the attractiveness of Connecticut. As Connecticut becomes more attractive migration into the area will increase. The influx of people into

[2] Due to the large medical and insurance industry in Connecticut, the multiplier effects of a loss or gain may be larger then other regions.

the state increase the total amount of money (Real Disposable Income). Because State Revenue is dependent upon the amount of Real Disposable Income that will rise as well. Population increases by 41 people increasing the amount of Real Disposable Incomes by $3.3 million and the amount of revenue collected by the State of Connecticut by $810 thousand.

The final forecast combines the COBRA simulations with the final oil and natural gas simulation. It is important to note that negative impact due to the loss in revenue in the medical and insurance industry is relatively small when weighed against the positive impact of enacting the oil and natural gas conservation policies. The total economic impact of oil and natural gas policies have upon the State of Connecticut is positive. The benefits of the policies will increase employment roughly by 1,670 jobs by 2020. Output will increase by $3.094 billion and Gross State Product will increase by $2.03 billion by 2020. Population will increase by 1,724 people, Real Disposable Income will increase by $1.758 billion dollars and State Revenues collected by Connecticut will increase by $382 million dollars.

Figure 9.

About REMI

Regional Economic Models, Inc. (REMI) is the nation's leading provider of economic forecasting and policy analysis software. The REMI Policy Insight model is used by over half of state governments, and numerous consulting firms, cities, and universities. Established in 1980, REMI has published model developments in the *American Economic Review*, the *Review of Economics and Statistics*, and other highly regarded publications.

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