STATE OF NEW MEXICO
BEFORE THE ENVIRONMENTAL IMPROVEMENT BOARD

IN THE MATTER OF PROPOSED REGULATION
20.2.350 NMAC – *GREENHOUSE GAS CAP AND TRADE PROVISIONS*
No. EIB 10-04 (R)

DIRECT TESTIMONY OF ADAM ROSE

I am pleased to be here today to present the results of my study of the economy-wide impacts of the New Mexico Environment Department proposal to reduce greenhouse gas (GHG) emissions in the state. Climate change policy is the subject of considerable debate, and these results are intended to shed light on one major aspect of the controversy.

I should begin by noting my background and credentials. I received my Ph.D. in economics from Cornell University in 1974, and have been involved in energy, environmental, and the regional economic research and policy advising for more than 35 years. My research has been funded by the U.S. Department of Energy, U.S. Environmental Protection Agency, several state government agencies, and several major private sector companies. Most recently, I performed similar studies to the one I am presenting today for the Florida Governor's Office, Pennsylvania Department of Environmental Protection, Michigan Department of Environmental Quality, and Wisconsin Public Service Commission. My work in general, and these studies in particular, have gone through extensive peer-review. In 2009, a collection of my major professional papers was reprinted in a volume entitled *The Economics of Climate Change Policy: International, National and Regional Mitigation Strategies* (Edward Elgar

Publishing Company). I also have served on the Editorial Boards of *Energy Policy, Resource and Energy Economics*, and *Journal of Regional Science.*

I am currently a Research Professor in the School of Policy, Planning and Development at the University of Southern California. During my career, I have served as an Assistant Professor at the University of California, Riverside; Professor and Chair of the Department of Mineral Resource Economics at West Virginia University; and Professor and Head of the Department of Energy, Environmental, and Mineral Economics at Pennsylvania State University. Today, I am here in my capacity as principal of my firm, Adam Z. Rose and Associates, which conducted this study.

I. OVERVIEW OF FINDINGS

Let me begin by providing you with an overview of my findings. My results indicate that most of the seven GHG mitigation policy cases I examined would have a very small negative impact on the state's economy by the Year 2020, though two of the cases yield slightly positive impacts. In fact, these positive outcome cases are the more likely to transpire, because they most closely resemble the New Mexico policy proposal of a combination of complementary polices plus cap and trade, but with free-granting of allowances.

We estimate employment impacts of the proposed policies to be rather small, ranging from a gain in the Year 2020 of 2,500 jobs in the case of full implementation of complementary policies, to a loss of 3,100 jobs in a case where the complementary policies are implemented at only half of their potential effectiveness. Again, the positive outcome is the more likely one. Therefore, our best estimate of the impacts of the proposed implementation of the Department's proposed rule (Western Climate Initiative

Policy Case) on the New Mexico economy is a slightly positive impact on Gross State Product and employment on the order of approximately one-tenth to two-tenths of one percent (0.001 to 0.002) on major economic indicators over the course of the planning horizon.

Our results for five of the seven cases indicate that electricity prices will fall for both residential and non-residential customers, and by as much as 3 percent primarily because of the strong effect of energy conservation. The results presented here are similar to those found by my analyses in other states. In fact my analyses of climate action plans in Florida, Pennsylvania, and Michigan showed even more positive impacts because of the use of more optimistic input data regarding energy efficiency, renewable energy, and other mitigation options. The economic gains stem primarily from the ability of mitigation options to lower the cost of production. Improvements in energy efficiency and subsequent reduced production costs lead to higher consumer purchasing power. The results also stem from the stimulus of increased investment in energy-saving equipment.

Note that, from a broader perspective, the estimates of economic benefits reported in this study represent a lower bound. Specifically, these benefits do not include the avoidance of damage from climate change resulting frpm unmitigated GHG emissions, the reduction in damage from the associated decrease in ordinary pollutants, the reduction in the use of natural resources, and the reduction in traffic congestion.

The Board is referred to Tables ES1 and ES2 for more details of our results.

Table ES1. Aggregate Economic Impacts of WCI Policy Scenarios
(GSP and income figures in million 2008$)

Scenario	Gross State Product Impacts		Income Impacts		Employment Impacts (Year 2020 Only)	
	Level (2010-2020 NPV)[a]	Percent (2020)	Level (2010-2020 NPV)	Percent (2020)	Level	Percent
1. Complementary	$674	0.17%	$125	0.02%	2,579	0.22%
2. Cap 5+CP	$542	0.13%	$93	-0.01%	2,171	0.18%
3. Cap 20+CP	$169	-0.02%	-$149	-0.11%	744	0.06%
4. Cap 40+CP	-$295	-0.18%	-$444	-0.23%	-763	-0.06%
5. Cap 50+CP-Half	-$1,038	-0.38%	-$856	-0.36%	-3,109	-0.26%
6. Cap 5+CP-HP	-$855	-0.42%	-$368	-0.20%	-721	-0.06%
7. Cap 20+CP-HP	-$1,167	-0.56%	-$567	-0.30%	-2,047	-0.17%

[a] NPV is Net Present Value.

Table ES2. Electricity Price Impacts of WCI Policy Scenarios (without allowance cost effect)

	Residential (% change for selected years)			Non-Residential (% change for selected years)		
Scenario	2012	2015	2020	2012	2015	2020
1. Complementary	-1.66%	-4.42%	-2.86%	-1.98%	-5.25%	-3.35%
2. Cap 5+CP	-1.66%	-4.42%	-2.86%	-1.97%	-5.24%	-3.34%
3. Cap 20+CP	-0.76%	-1.59%	-2.41%	-0.89%	-1.84%	-2.80%
4. Cap 40+CP	1.63%	-1.98%	-1.82%	1.98%	-2.31%	-2.10%
5. Cap 50+CP-Half	-0.41%	-0.41%	-0.70%	-0.48%	-0.44%	-0.78%
6. Cap 5+CP-HP	1.57%	4.63%	14.05%	1.91%	5.67%	17.30%
7. Cap 20+CP-HP	-0.27%	4.80%	14.07%	-0.30%	7.43%	17.32%

II. THE REMI PI^{+} MODEL

Several modeling approaches can be used to estimate the total regional economic impacts of environmental policy, including both direct (on-site) effects and various types of indirect (off-site) effects.

The choice of which model to use depends on the purpose of the analysis and performance criteria, such as accuracy, transparency, manageability, and cost. After careful consideration of these criteria, the Department selected the Regional Economic Models, Inc. (REMI) Policy Insight Plus (PI^{+}) Model. My research team has used this model successfully in similar analyses in the states of Florida, Pennsylvania, Michigan, and Wisconsin.

The REMI Model has evolved over the course of 30 years of refinement. It is a packaged program, but is built with a combination of national and region-specific data. Government agencies in practically every state in the U.S. have used a REMI Model for a variety of purposes, including evaluating the impact of changing tax rates, the entry and exit of major businesses, the implementation of economic programs in general, and more recently, the impacts of energy and/or environmental policy actions.

The macroeconomic character of the model is able to analyze the interactions between sectors (ordinary multiplier effects), but with additional refinement for price changes. In other words, the REMI model incorporates the responses of producers and consumers to price signals in the simulation. The REMI Model also brings into play features of labor and capital markets, as well as trade with other states or countries, including changes in competitiveness.

Note that the REMI Model is based both on national and New Mexico-specific data. Before utilizing the model, we carefully checked its major features. We also reconciled its baseline forecast with New Mexico-specific data, as explained in one of the Appendices of our report.

III. INPUT DATA

The major data used in our analysis were a set of findings on the direct cost and savings of individual GHG mitigation options. These data were taken from policy simulations performed by ICF International for the Western Climate Initiative (WCI) using the ENERGY 2020 model. That model is based on extensive data and research by the U.S. Department of Energy. However, the quantification analysis of the costs/savings of policy options in the WCI ENERGY 2020 model is limited to the direct effects of their implementation. For example, the direct costs of an energy efficiency option include the energy customers' expenditure on energy efficiency equipments and devices, and the savings on energy bills of the customers.

Before undertaking any economic simulation, the costs and savings for the policy options are translated into model inputs that can be utilized in the REM PI$^+$ Model. This step involves the selection of appropriate policy levers in the REMI PI$^+$ Model to simulate the policy's changes. The input data include sectoral spending and savings between 2010 and 2020, the full time horizon of the analysis.

In our study we performed analyses on two sets of GHG mitigation policy options: (1) the "complementary policies" of Energy Efficiency (EE), Clean Car Standards, and Vehicle Miles Traveled (VMT) Reductions; and (2) the set of mitigation options implemented under a cap and trade program. Appendix A of my testimony

presents the mapping of ENERGY 2020 Model outputs into REMI inputs for an example policy.

The following ENERGY 2020 data, in real dollar values, are utilized as input data in the REMI PI$^+$ Model:

1. Annualized Device Investment;
2. Annualized Process Investment;
3. Operations and maintenance (O&M) Expenditures;
4. Annual Fuel Expenditures; and
5. Generating Utility Costs (by generation type).

IV. SIMULATION SET-UP

Figure 1 shows how a policy simulation process is undertaken in the REMI PI$^+$ Model. First, a policy question is formulated, for example, "What would be the economic impacts of implementing the Energy Efficiency Programs?" Second, external policy variables that would embody the effects of the policy are identified, for example, in the case of Energy Efficiency, relevant policy variables include incremental costs and investment in energy efficient appliances; final demand increase in the sectors that produce the equipments and appliances; and the avoided consumption of electricity and natural gas. Third, baseline values for these policy variables are used to generate the control forecast (also known as the baseline forecast). Fourth, an alternative forecast is generated by changing the values of the external policy variables. Usually, the different values of these variables represent the direct effects of the simulated policy scenario. Finally, the effects of the policy scenario are measured by comparing the baseline and alternative forecasts.

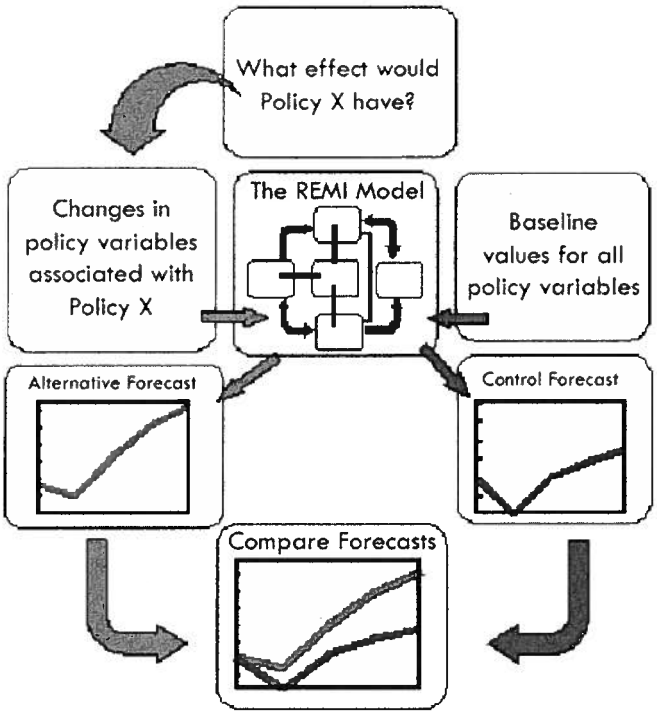

Figure 1. Process of Policy Simulation in REMI

V. CASES ANALYZED

We examined seven policy cases consistent with the simulations performed by ICF about the potential impact of the policy proposal. The cases varied according to effectiveness of complementary policies, background considerations, and assumptions about emissions allowance prices. The seven cases are:

1. Aggregated Complementary Policies Case: Complementary policies are often adopted in conjunction with a Cap-and-Trade (C&T) program. These policies are identified to promote emission reductions that are not responsive to price signals. In the WCI program, three complementary policies are included in the analysis. They are Clean Car Standards, Energy Efficiency, and Vehicle Miles Traveled. In this policy case, we evaluate the macroeconomic impacts of a combination of these three complementary policies in New Mexico alone.

2. Cap 5+CP Case (C&T plus complementary policies: $5 allowance price): Cases 2 to 4 correspond to the Main Policy Case in the WCI analysis. The Cap 5+CP case evaluates the impacts of the WCI C&T program in conjunction with the three complementary policies on the New Mexico economy. The primary set of Economic Modeling Team assumptions on future socio-economic conditions is adopted in this case. Also, the ENERGY 2020 model assumes that the allowance price in Year 2020 is $5/ton, which is the lowest allowance price analyzed by ICF for the Main Policy Case. As a result this policy case represents the closest approximation to the Department's proposal for free distribution of GHG emission allowances.

3. Cap 20+CP Case (C&T plus complementary policies: $20 allowance price): In the WCI analysis, the equilibrium allowance price of the Main Policy Case is $33/ton. Therefore, we analyzed $20/ton and $40/ton allowance price scenarios as sensitivity bounds for the Main Policy Case in this case and the following one. The $20/ton price is the lower bound for the allowance price.

4. Cap 40+CP Case (C&T plus complementary policies: $40 allowance price): This is the upper-bound sensitivity case for the $33/ton allowance price of the Main Policy Case.

5. Cap 50+CP-Half Case (C&T with VMT and EE cut in Half: $50 allowance price): This is the sensitivity case on the effectiveness of the complementary policies. This case assumes that only half of the emission reduction targets for energy efficiency and VMT can be achieved, but that the emission reduction target for the clean car standards can be fully achieved. The WCI analysis indicates an allowance price of at

least $50/ton for mitigation compliance of the whole region in this case. Therefore, we analyzed the $50/ton allowance price scenario for this policy case.

6. Cap 5+CP-HighPrice Case (C&T with 50% Increase in Energy Prices and 30% Higher Construction Costs: $5 allowance price): This and the following case assume that energy prices will increase in real terms by 50% by 2020 compared with 2008 prices. The capital cost and the O&M cost for power generation are assumed to be 30% higher than the Main Policy Case. Both of these price assumptions are intended to provide reasonable upper bounds for key prices in the estimates. In the WCI analysis, the equilibrium allowance price of the High Price Case is $13/ton. Therefore, the $5/ton scenario represents our lower-bound sensitivity case for the allowance price.

7. Cap 5+CP-HighPrice Case (C&T with 50% Increase in Energy Prices and 30% Higher Construction Costs: $20 allowance price): The $20/ton scenario represents our upper-bound sensitivity case for the allowance price of the High Price Policy Case.

VI. RESULTS

I next will present a brief summary of the impacts of each policy case on the macroeconomic indicators of gross state product (GSP) income and employment. I also will summarize the results for the three most affected economic sectors (out of the 169 sectors analyzed in the REMI PI$^+$ Model. Finally, I will summarize the impacts on electricity prices, gasoline prices, state tax revenues, and emission reductions.

Our results indicate that most of the scenarios (Cases 3-7) would have a very small negative impact on the State's economy by Year 2020. However, two of the cases (Cases 1 and 2) yield slightly positive impacts. These cases are in fact the more likely outcomes of the Department's proposed rule. This is because the ENERGY 2020 model

assumes that 100% of the allowances will be auctioned and the allowance costs will be automatically passed through to energy consumers. However, New Mexico proposes to freely allocate its allowances, so there will be no additional cost pressures. Therefore, the lowest allowance price scenario of the Main Policy Case best resembles the likely policy case in New Mexico.

Table 1 presents the aggregate economic impacts of the seven policy cases.

Table 1. Aggregate Economic Impacts of WCI Policy Scenarios
(GSP and income figures in million 2008$)

Scenario	GSP Impacts		Income Impacts		Employment Impacts (Year 2020 Only)	
	Level (2010-20 NPV)	Percent (2020)	Level (2010-20 NPV)	Percent (2020)	Level	Percent
1. Complementary	$674	0.17%	$125	0.02%	2,579	0.22%
2. Cap 5+CP	$542	0.13%	$93	-0.01%	2,171	0.18%
3. Cap 20+CP	$169	-0.02%	-$149	-0.11%	744	0.06%
4. Cap 40+CP	-$295	-0.18%	-$444	-0.23%	-763	-0.06%
5. Cap 50+CP-Half	-$1,038	-0.38%	-$856	-0.36%	-3,109	-0.26%
6. Cap 5+CP-HP	-$855	-0.42%	-$368	-0.20%	-721	-0.06%
7. Cap 20+CP-HP	-$1,167	-0.56%	-$567	-0.30%	-2,047	-0.17%

The following discussion summarizes the results of each case:

1. Aggregate Complementary Policies: This case has the strongest positive impact on the New Mexico economy. We project an increase of $674 million dollars in net present value (time-discounted) terms over the planning horizon 2010-2020. The impacts are positive in the Year 2020 itself. The increase in gross state product (GSP) of 0.17 percent of economic activity translates into an increase of $150 million in GSP. Employment gains in the Year 2020 are over 2,500 jobs in terms of person-year

equivalents, or a 0.22 percent increase over baseline. The positive impacts stem primarily from cost savings associated with energy efficiency and reduced costs of transportation.

2. Cap 5+CP (C&T plus complimentary policies: $5 allowance price): This case yields positive impacts similar to Case 1. It differs from Case 1 only in that it adds a cap and trade feature, which has a minimal dampening influence because the allowance price is so low.

3. Cap 20+CP (C&T plus complimentary policies: $20 allowance price): This case also yields a positive impact, though it is extremely small over the entire planning horizon. The employment increase is only 0.06 percent, and in fact the GSP impact turns slightly negative by Year 2020. This case is not as attractive as the previous one because of the higher allowance price.

4. Cap 40+CP (C&T plus complimentary policies: $40 allowance price): This case yields uniformly negative impacts on the New Mexico economy, though they are rather small. The GSP impact in the Year 2020 is -0.18 percent, and the employment impact in that year is -0.06 percent.

5. Cap 50+CP-Half (C&T with VMT and EE policies at half the previous levels: $50 allowance price): In this case, the negative impacts grow significantly. The GSP decrease is 0.38 percent in the Year 2020 and the employment decrease is -0.26 percent, or slightly more than 3,000 jobs. In terms of employment, this is the worst case scenario. This case also yields the most negative GSP impacts in the Year 2020. The negative impacts stem from the lower effectiveness of the VMT and EE complementary policies, which are the policies most capable of generating cost savings. Even at half-strength,

however, it is notable that the economic impact is not significantly more negative than other cases.

6. Cap 5+CP-HighPrice (C&T with a 50 percent increase in all energy prices and 30 percent increase in construction costs: $5 allowance price): This case yields negative impacts on the economy on the order of a 0.42 percent decrease in GSP in the Year 2020 and a loss of 721 jobs. The negative outcome is due primarily to the condition of high energy prices relative to baseline conditions.

7. Cap 20+CP-HighPrice (C&T with a 50 percent increase in all energy prices and 30 percent increase in construction costs: $20 allowance price): This case yields the most negative impacts of all the cases in terms of net present value of GSP impacts over the planning horizon. However, the income and employment impacts in the Year 2020 are not as low as in case 5. The GSP loss in 2020 is $567 million, or 0.3 percent of the projected baseline. The 2020 employment loss amounts to just slightly above 2,000 jobs, or a decrease of 0.17 percent of projected baseline.

It is critical to recognize that these analyses assume the auction of allowances. In the auction scenario, out-of-pocket expenditures to purchase allowances will increase the emitters' cost of production, which they will attempt to pass to their customers in the form of higher prices. This in turn increases the cost of production in other businesses, and continues through successive rounds of ripples of cost-push inflation. Moreover, it decreases the purchasing power of household income. All of this comes together to yield more negative impacts than otherwise.

The situation in New Mexico is different than the general WCI case. In New Mexico, the Department proposes to distribute free allowances. Thus, there should be no

price pressures from the cap and trade aspect. While ICF International did not simulate this case in the ENERGY2020 Model, we can interpolate it as falling somewhere between the Complementary Policies Case, which contains no allowance trading, and the Cap 5+CP Case, which assumes a $5 allowance price. Both cases yield positive impacts on the New Mexico economy in all respects. Therefore, our best estimate of the impacts of the Department's proposed rule on the New Mexico economy is a slightly positive impact on the order of approximately one-tenth to two tenths of 1 to 2 percent (0.001 to 0.002) on major economic indicators over the course of the planning horizon and in the terminal Year 2020 These positive impacts stem primarily from cost-saving mitigation options associated with the proposed policies, such as savings from energy efficiency and transportation/land use policies throughout the policy horizon, and the increasing attractiveness of renewable electricity, as their technological costs decline with experience and improvements in economies of scale and the prices of non-renewable fossil fuels increases in the baseline.

Table 2 presents the impacts of the seven cases on electricity prices. In Cases 1, 2, 3 and 5, and in Case 4 starting in 2015, we actually project a decrease in these prices. This result stems primarily from the negative shift in demand associated with energy efficiency and other types of conservation. The positive increases in electricity prices in Cases 6 and 7, and in early years of Case 4, stems from the existence of high energy prices in comparison to the baseline and a high allowance price.

Table 2. Electricity Price Impacts of WCI Policy Scenarios (without allowance cost effect)[a]

	Residential (% change for selected years)			Non-Residential (% change for selected years)		
Scenario	2012	2015	2020	2012	2015	2020
1. Complementary	-1.66%	-4.42%	-2.86%	-1.98%	-5.25%	-3.35%
2. Cap 5+CP	-1.66%	-4.42%	-2.86%	-1.97%	-5.24%	-3.34%
3. Cap 20+CP	-0.76%	-1.59%	-2.41%	-0.89%	-1.84%	-2.80%
4. Cap 40+CP	1.63%	-1.98%	-1.82%	1.98%	-2.31%	-2.10%
5. Cap 50+CP-Half	-0.41%	-0.41%	-0.70%	-0.48%	-0.44%	-0.78%
6. Cap 5+CP-HP	1.57%	4.63%	14.05%	1.91%	5.67%	17.30%
7. Cap 20+CP-HP	-0.27%	4.80%	14.07%	-0.30%	7.43%	17.32%

[a] The production cost increases of the power sector due to the purchase of any allowances (or the allowance cost the power sector may pass through to its customers) are not included in the calculation in this table.

Table 3 presents the impacts of the seven cases on gasoline prices for the residential sector and the delivered price of the petroleum products sector. Gasoline prices are projected to increase 0.04 percent for each policy case in the Year 2012, increasing to between 0.14 and 0.18 percent in Year 2015, and 0.27 to 0.34 percent in Year 2020. Petroleum price increases are about 50 percent higher for each of these years. The increases are highest in those cases where allowance prices are highest, energy prices are highest, or VMT and EE polices are not fully implemented.

Table 3. Petroleum Price Impacts of WCI Policy Scenarios (without allowance cost effect) [a]

	Residential Gasoline Price Change (% change for selected years)			Delivered Price Change Refined Petroleum Products[b] (% change for selected years)		
Scenario	2012	2015	2020	2012	2015	2020
1. Complementary	0.04%	0.14%	0.27%	0.06%	0.23%	0.45%
2. Cap 5+CP	0.04%	0.14%	0.27%	0.06%	0.23%	0.46%
3. Cap 20+CP	0.04%	0.18%	0.31%	0.06%	0.25%	0.47%
4. Cap 40+CP	0.04%	0.21%	0.34%	0.07%	0.26%	0.50%
5. Cap 50+CP-Half	0.03%	0.21%	0.33%	0.05%	0.23%	0.45%
6. Cap 5+CP-HP	0.04%	0.14%	0.28%	0.07%	0.25%	0.52%
7. Cap 20+CP-HP	0.04%	0.18%	0.31%	0.06%	0.26%	0.54%

[a] The impacts in this table do not include the direct or indirect production cost increases due to the need of the Petroleum Refining sector to purchase any allowances.
[b] Also includes a small amount of refined coal products.

Table 4 presents the tax revenue impacts of the seven cases. These impacts do not include any allowance auction revenue, but this is actually a plus here, because the Department's proposed rule does not call for any revenue to be generated. The impacts are trivial in the Year 2012, but take on some significance by the Year 2015. They follow the general trends of the macro impacts on GSP (see Appendix C), that is, they are positive when GSP impacts are positive and negative when impacts are negative. For the Year 2020, this comparison is more evident when the two series track perfectly in a qualitative way, i.e., only Cases 3-7 are negatively impacted in terms of both GSP and tax revenues.

Table 4. Tax Revenue Impacts of WCI Policy Scenarios

Scenario	2012	2015	2020
1. Complementary	0.032%	-0.006%	0.029%
2. Cap 5+CP	0.033%	-0.025%	0.000%
3. Cap 20+CP	0.035%	-0.082%	-0.110%
4. Cap 40+CP	0.046%	-0.170%	-0.231%
5. Cap 50+CP-Half	0.020%	-0.255%	-0.368%
6. Cap 5+CP-HP	0.018%	-0.125%	-0.200%
7. Cap 20+CP-HP	0.024%	-0.178%	-0.299%

Appendix B presents the results in relation to major sectors positively and negatively affected by the proposed policy. Table B1 shows the results in terms of impacts in absolute terms, while Table B2 shows the impacts in relative (percentage) terms. The results are predictable, with decreases in sectors such as electricity, coal mining, and petroleum refining, and increases in sectors relating to household spending and renewable energy.

The results of each case for each year of the planning horizon and for a broader set of economic indicators are presented in the tables in Appendix C. In all the cases, the impacts start out positive in Year 2010. In Cases 1 and 2, the impacts are positive throughout the entire planning horizon. The positive impacts decrease starting in Year 2012 and reach a trough in 2016. Then the positive impacts climb up gradually and reach their highest level in the Year 2020. In Cases 3 to 7, the positive impacts decrease starting in Year 2012. The impacts turn negative starting in 2014 and remain negative through Year 2020.

Finally, Table 5 presents the impacts on New Mexico's GHG emissions for the seven policy cases in the Year 2020.

Table 5. GHG Emission Reductions by Policy Case, Year 2020 (all emissions are in MMtCO2e)

Policy Case	Year 2020 Baseline Emissions	Year 2020 Emissions Target (10% below 2000 level)[a]	ENERGY2020 Post-Policy Emissions		Emissions after REMI Macro Run	
			Level	Reduction	Level	Reduction
1. Complementary	71.6	63.99	70.07	1.53	69.98	1.62
2. Cap 5+CP	71.6	63.99	69.74	1.86	69.64	1.96
3. Cap 20+CP	71.6	63.99	70.25	1.35	70.09	1.51
4. Cap 40+CP	71.6	63.99	70.03	1.57	69.80	1.80
5. Cap 50+CP-Half	71.6	63.99	70.47	1.13	70.13	1.47
6. Cap 5+CP-HP	71.6	63.99	69.27	2.33	68.10	3.50
7. Cap 20+CP-HP	71.6	63.99	69.13	2.47	67.91	3.69

[a] Year 2000 production-based emissions (excluding sinks and emissions from Indian lands) are 71.1 MMtCO2e.

The first numerical column shows the baseline emissions, which are 71.6 MMtCO2e. The second numerical column shows the emissions target for Year 2020, which is established as 10% below the Year 2000 level by the Year 2020. New Mexico Year 2000 production-based gross emissions level (excluding forestry, land use sinks, and emissions from Indian lands) was 71.1 MMtCO2e. The Year 2020 emissions target is then calculated as 63.99 MMtCO2e (or an emission reduction target of 7.61 MMtCO2e).

The third and fourth columns show the ENERGY 2020 post-policy GHG emissions level and the emission reductions achieved (which is the difference between the baseline emissions level and the ENERGY 2020 post-policy emissions level). From these two columns we can see that there are only slight differences in New Mexico GHG emission reductions across the seven simulated policy cases. In all the cases, New

Mexico reduces emissions between 1.5 and 3.7 MMtCO2e through its own mitigation activities (or 19 percent to 48 percent of the of total emission reduction target of 7.61 MMtCO2e). None of the scenarios has a sufficiently high allowance price to incentivize facilities to implement emission reduction options to meet the emission reduction requirement proposed by the Department. Instead the more cost-effective way for New Mexico sources to meet their compliance obligations would be to purchase emission allowances from other jurisdictions in the WCI trading system. Therefore, while the regional emission reduction target would be met, the state emission reduction target would not under any of the seven policy cases.

It is to be expected that in any cap-and-trade program, some jurisdictions will be net buyers of allowances and others will be net sellers of allowances. The geography of the emission reduction is not important because GHGs are global pollutants, i.e., mitigation is equally effective at any location. This is one of the main advantages of cap and trade vs. command and control for GHGs, because it promotes the use of lowest cost options, with no need to be concerned about the geographic distribution or concentration of emissions.

In economic terms, New Mexico would choose to mitigate emissions only up to the point where the marginal cost equals the allowance price. At this point, it is cheaper, or more cost-effective, for New Mexico facilities to purchase emission allowances from other WCI jurisdictions to meet their remaining compliance obligations. In meeting the regional reduction target, the lower-cost partners would mitigate more emissions than required by their respective reduction targets, and then sell their excess allowances in a secondary market. For the WCI region, the overall emission reduction goal wouldl be

achieved at an equilibrium allowance price of $33/tCO2e in the base (main) policy case. The ENERGY 2020 Model indicates that New Mexico would meet its entire reduction goal through its own mitigation efforts only when the allowance price exceeds $100/tCO2e in the base case. Of course, with such a high allowance price level, the WCI region would over-comply with the Year 2020 emission reduction target because the jurisdictions would exceed their respective emission reduction targets to avoid paying the high price to purchase allowances for any unabated emissions.

The last column of Table 5 presents the influence of macroeconomic effects on New Mexico emissions in the Year 2020 (projections are based on a combination of GHG emission coefficients from ENERGY2020 Model and sectoral outputs from the REMI PI^{+} Model) and the total emission reductions after accounting for the macroeconomic effects. In all seven cases, the change in macroeconomic activities further reduces the GHG emissions, though by no more than 2 percent. In the Complementary and Cap 5+CP Cases, although the gross output of the economy increases slightly in the Year 2020, the economy-wide emissions decline because the economic structure shifts to less emission-intensive sectors. The two High-Price Cases have the largest macroeconomic impacts on emissions because (1) the total output decreases more in these two cases than in the other cases; and (2) under the high energy price assumptions, the energy supply sectors are mostly negatively affected in these cases, e.g., the emission coefficients for these sectors are much higher than the expanded service and trade sectors.

VI. COMPARISON TO OTHER STUDIES

The results presented here are similar to those found in other states. In fact, my analyses of climate action plans in states such as Florida, Pennsylvania and Michigan showed even greater positive impacts because of the use of more optimistic input data regarding energy efficiency, renewable energy, other mitigation options, and *no* C&T program.

VII. CONCLUSION

My study analyzed the impacts of the WCI Phase 3 policies on the New Mexico economy. We used a state of the art macroeconometric model known as REMI PI+ to perform this analysis. The analysis is based on the simulation of the direct economic impacts of policy cases and data provided by the New Mexico Environment Department and ICF International.

Among the seven policy cases we evaluated, the aggregate Complementary Policies case and the base C&T policy case with a relatively low allowance price (Cap 5+CP case) yield slightly positive impacts on the state's economy over the planning horizon. The increase in Net Present Value of Gross State Product is about $600 million in each case and the increase in employment in Year 2020 is between 2,000 and 2,500 full-time equivalent jobs. The analysis on the base C&T policy case with a relatively high allowance price - the policy case involving less effective implementation of complementary policies - and the cases with assumptions of higher energy prices and construction costs all yield slightly negative impacts to the economy.

The Department's proposed rule calls for free distribution of the GHG emission allowances. Because of the data limitation of the ENERGY 2020 simulations, we cannot

model an allowance free-granting case directly, but we nonetheless are able to conclude that the impacts of the Department's proposed rule falls somewhere between the Complementary Policies case (e.g., no allowance trading case) and the Cap 5+CP case (e.g., lowest allowance price case). Therefore, our best estimate of the impacts of the Department's proposed rule (Western Climate Initiative Policy Case) on the New Mexico economy is a slightly positive impact on the order of approximately one-tenth to two-tenths of one percent (0.001 to 0.002) on major economic indicators over the course of the planning horizon and in the terminal Year 2020.

Appendix A. Mapping Table of ENERGY 2020 Direct Economic Impacts and REMI Policy Variables for an Example Policy Case

ENERGY 2020 Direct Economic Impact	REMI Policy-Related Variable	Notes and Additional Assumptions
1. Change in Annualized Device Investment of the following sectors: Residential Commercial Paper Chemicals Petroleum Nonmetallic Minerals Primary Metals Mining Except Oil and Gas Oil and Gas Extraction Other Industry Passenger Transportation Freight Transportation Agriculture Waste & Wastewater	<u>Non-Transportation Commercial and Industrial Sectors</u>: Investment Expenditure Impacts: Compensation, Prices, and Costs Block→Capital Cost (amount) for individual REMI non-transportation commercial and industrial sectors→Increase in most sectors Investment Impacts on Equipment Supply Sectors: Output and Demand Block→Investment Spending (amount)→Producers Durable Equipment→Increase Interest Payment of Financing: Output and Demand Block →Exogenous Final Demand (amount) for Monetary Authorities, Credit Intermediation sector→Increase <u>Transportation Sectors</u>: Freight Transportation: Investment Expenditure Impacts: Compensation, Prices, and Costs Block→Capital Cost (amount) for Truck Transportation sector and Rail Transportation sector→Decrease in early years and increase in later years Investment Impacts on Transportation Equipment Mfg sectors: Output and Demand Block→Exogenous Final Demand (amount) of the Motor Vehicle Mfg sector, Motor Vehicle Parts Mfg sector, and Railroad Rolling Stock Mfg sector→Decrease in early years and increase in later years Interest Payment of Financing: Output and Demand Block →Exogenous Final Demand (amount) for Monetary Authorities, Credit Intermediation sector→ Decrease in early years and increase in later years <u>Residential Sector</u>: *Energy Efficiency Appliances and Devices*: Investment Expenditure Impacts: Output and Demand Block→Consumer Spending (amount)→Kitchen & Other Household Appliances and Video & Audio Goods→Increase Investment Impacts on Equipment Supply Sectors: Through internal linkages of the Consumer Spending variable and Final Demand variable of affected manufacturing sectors.	Changes in the value of Device Investment can be treated as capital investment to energy efficiency equipment. The REMI Model has a much more disaggregated sectoring scheme than the ENERGY 2020 model. We distribute the energy efficiency investment expenditures among relevant REMI commercial and industrial sectors using sectoral energy consumption as weights. For the Truck Transportation sector, we split the capital investment 9:1 between Motor Vehicle Mfg sector and Motor Vehicle Parts Mfg sector. We assume 50% of the capital investment will come from financing and the interest payment accounts for around 30% of the total financed capital investment.

	Interest Payment of Financing: Output and Demand Block→Consumer Spending (amount)→ Bank Service Charges →Increase Consumption Reallocation among Goods: Output and Demand Block→Consumption Reallocation (amount)→All Consumption Categories→Decrease *Passenger Cars*: Investment Expenditure Impacts: Output and Demand Block→Consumer Spending (amount)→New Autos, Net Purchases of Used Autos, Other Motor Vehicles, and Motor Vehicle Parts→Decrease Investment Impacts on Vehicle and Vehicle Parts Suppliers: Through internal linkages of the Consumer Spending variable and Final Demand variable of affected manufacturing sectors. Interest Payment of Financing: Output and Demand Block→Consumer Spending (amount)→ Bank Service Charges →Decrease Consumption Reallocation among Goods: Output and Demand Block→Consumption Reallocation (amount)→All Consumption Categories→Increase	
2. Change in Annualized Process Investment of the following sectors: Residential Commercial Paper Chemicals Petroleum Nonmetallic Minerals Primary Metals Mining Except Oil and Gas Oil and Gas Extraction Other Industry Passenger Transportation Freight Transportation Agriculture Waste & Wastewater	<u>Non-Transportation Commercial and Industrial Sectors</u>: Investment Expenditure Impacts: Compensation, Prices, and Costs Block→Capital Cost (amount) for individual REMI non-transportation commercial and industrial sectors→Increase in most sectors Investment Impacts on Building Materials Supply Sectors: Output and Demand Block→Exogenous Final Demand (amount) of Construction sector, Glass and Glass Product Mfg sector, Plastics Product Mfg sector, Other Non-Metallic Mineral Product Mfg sector, Veneer, Plywood, and Engineered Wood Product Mfg sector, Clay Product and Refractory Mfg sector→Increase Interest Payment of Financing: Output and Demand Block →Exogenous Final Demand (amount) for Monetary Authorities, Credit Intermediation sector→Increase <u>Residential Sector</u>: Investment Expenditure Impacts: Output and Demand Block→Consumer Spending (amount)→Other Durable House Furnishings→Increase Investment Impacts on Equipment Supply Sectors: Through internal linkages of the	Process investment is investment to improve building efficiency. Again, we use the sectoral energy consumption as weights to distribute the investment cost across relevant REMI commercial and industrial sectors. For the Industrial sectors, we assume that 50% of the investment goes to the Construction sector, 20% to Glass and Glass Product Mfg sector, 10% to Plastics Product Mfg sector, 10% to Other Non-Metallic Mineral Product Mfg sector, and 10% to Clay Product and Refractory Mfg sector. For the Commercial sectors, we

	Consumer Spending variable and Final Demand variable of affected manufacturing sectors. Interest Payment of Financing: Output and Demand Block→Consumer Spending (amount)→ Bank Service Charges →Increase Consumption Reallocation among Goods: Output and Demand Block→Consumption Reallocation (amount)→All Consumption Categories→Decrease	assume that 40% of the investment goes to the Construction sector, 20% to Glass and Glass Product Mfg sector, 10% to Plastics Product Mfg sector, 10% to Other Non-Metallic Mineral Product Mfg sector, 10% to Veneer, Plywood, and Engineered Wood Product Mfg sector, and 10% to Clay Product and Refractory Mfg sector.
3. Change in O&M Expenditures of the following sectors: Residential Commercial Paper Chemicals Petroleum Nonmetallic Minerals Primary Metals Mining Except Oil and Gas Oil and Gas Extraction Other Industry Passenger Transportation Freight Transportation Agriculture Waste & Wastewater	<u>Commercial and Industrial Sectors</u>: Cost Impacts: Compensation, Prices, and Costs Block→Production Cost (amount) for individual commercial and industrial sectors→Increase Stimulus/Dampening Impacts: Output and Demand Block→Industry Sales (amount) for each relevant commercial and industrial sector (assume the O&M activities are performed by the same sector that increases the O&M expenditure) →Increase in most sectors <u>Residential Sector</u>: *O&M of Energy Efficiency Appliances and Devices*: Cost Impacts: Output and Demand Block→Consumer Spending (amount)→Other Household Operation→Increase Stimulus Impacts: Through internal linkages of the Consumer Spending variable and Final Demand variable of affected O&M services providing sectors. Consumption Reallocation: Output and Demand Block→Consumer Reallocation (amount)→All Consumption Categories→Decrease *O&M of Passenger Vehicles*: Cost Impacts: Output and Demand Block→Consumer Spending (amount)→Motor Vehicle Repair, Rental, Leasing→Decrease in early years and increase in later years Stimulus Impacts: Through internal linkages of the Consumer Spending variable and Final Demand variable of affected O&M services providing sectors. Consumption Reallocation: Output and Demand Block→Consumer Reallocation (amount)→All Consumption Categories→ Increase in early years and decrease in later years	Again, we use sectoral energy consumption as weights to distribute the O&M cost across relevant REMI commercial and industrial sectors.
4. Change in Fuel Expenditures of the following	<u>Non-Transportation Commercial and Industrial Sectors</u>: Cost Impacts: Compensation, Prices, and Costs Block→Electricity Fuel Cost (share) and	Under the policy runs, the fuel expenditures (in dollar value terms) are

sectors: Residential Commercial Paper Chemicals Petroleum Nonmetallic Minerals Primary Metals Mining Except Oil and Gas Oil and Gas Extraction Other Industry Passenger Transportation Freight Transportation Agriculture Waste & Wastewater	NG Fuel Cost (share) for individual REMI non-transportation commercial and industrial sectors→Increase Stimulus/Dampening Impacts to energy supply sectors: Output and Demand Block→Exogenous Final Demand (amount) of Electric Power Generation, Oil and Gas Extraction, Coal Mining, and Petroleum and Coal Products Manufacturing sectors→Decrease <u>Transportation Sectors</u>: Freight Transportation: Cost Impacts: Compensation, Prices, and Costs Block→ Residual Fuel Cost (amount) for the Truck Transportation sector→Decrease Stimulus/Dampening impacts to energy supply sectors: Output and Demand Block→Exogenous Final Demand (amount) of the Petroleum and Coal Products Manufacturing sector→Decrease <u>Residential Sector</u>: *Electricity and NG*: Output and Demand Block→Exogenous Final Demand (amount) of Electric Power Generation and Oil and Gas Extraction sectors→Decrease Consumption Reallocation: Output and Demand Block→Consumer Reallocation (amount)→All Consumption Categories→Increase *Gasoline*: Output and Demand Block→Exogenous Final Demand (amount) of Petroleum and Coal Products Manufacturing sector→Decrease Consumption Reallocation: Output and Demand Block→Consumer Reallocation (amount)→All Consumption Categories→Increase	estimated to go up for the non-transportation commercial sector, industrial sector, and residential sector. This is mainly because of the increased energy prices stemming from the high allowance price. However, energy use in quantity terms goes down. In the calculation, we use the fuel prices that exclude the effect of permits cost to compute the final demand change to the energy supply sectors. The (excluding permits) prices are obtained from the Complementary Policies Run.
5. Generating Utility Costs: Annualized Investments Fuel Expenditures O&M	Annualized Investments: Investment Expenditure Impacts to the Power sector: Compensation, Prices, and Costs Block →Capital Cost (amount) of Electric Power Generation sector→Decrease Investment Impacts on Construction and Equipment Mfg sectors: Output and Demand Block→Exogenous Final Demand (amount) of Construction sector and Engine, Turbine, Power Transmission Equipment Mfg sector→Decrease O&M:	Capital investment in power generation is split 60:40 between sectors that provide generating equipment and the construction sector for large power plants (such as coal-fired power plants), and 80:20 for smaller installations (mainly renewables).

	Cost Impacts to the Power sector: Compensation, Prices, and Costs Block →Production Cost (amount) of Electric Power Generation sector→Decrease Stimulus/Dampening Impacts: Output and Demand Block→Industry Sales (amount) of Electric Power Generation sector (assume the O&M activities are performed by the Power Generation sector) →Decrease Fuel Expenditures: Cost Impacts to the Power sector: Compensation, Prices, and Costs Block →Production Cost (amount) of Electric Power Generation sector→Decrease Stimulus/Dampening Impacts: Output and Demand Block→Final Demand (amount) of Coal Mining sector and Oil and Gas Extraction sector, Proprietors' Income of the Farm sector, and Industry Sales of Ag and Forestry sector →Decrease	

APPENDIX B

Table B1. Major Sectoral Impacts of WCI Policy Scenarios
(top 3 positive and negative impacted sectors in terms of absolute GSP impacts)

2012	2015	2020
1. Complementary		
Top 3 Positive Impact		
Offices of health practitioners	Offices of health practitioners	Offices of health practitioners
Real estate	Real estate	Retail trade
Telecommunications	Electric power generation, transmission, and distribution	Electric power generation, transmission, and distribution
Top 3 Negative Impact		
Automotive repair and maintenance	Automotive repair and maintenance	Construction
Wholesale trade	Construction	Petroleum refining
Coal mining	Coal mining	Coal mining
2. Cap 5+CP		
Top 3 Positive Impact		
Offices of health practitioners	Offices of health practitioners	Offices of health practitioners
Real estate	Real estate	Retail trade
Telecommunications	Electric power generation, transmission, and distribution	Electric power generation, transmission, and distribution
Top 3 Negative Impact		
Automotive repair and maintenance	Automotive repair and maintenance	Construction
Wholesale trade	Construction	Petroleum refining
Coal mining	Coal mining	Coal mining
3. Cap 20+CP		
Top 3 Positive Impact		
Offices of health practitioners	Offices of health practitioners	Offices of health practitioners
Real estate	Telecommunications	Retail trade
Telecommunications	Hospitals	Monetary authorities, credit

		intermediation
Top 3 Negative Impact		
Automotive repair and maintenance	Automotive repair and maintenance	Construction
Wholesale trade	Construction	Real estate
Automotive equipment rental and leasing	Retail trade	Petroleum refining
4. Cap 40+CP		
Top 3 Positive Impact		
Offices of health practitioners	Offices of health practitioners	Offices of health practitioners
Real estate	Hospitals	Automotive repair and maintenance
Telecommunications	Telecommunications	Truck transportation
Top 3 Negative Impact		
Automotive repair and maintenance	Retail trade	Construction
Wholesale trade	Construction	Real estate
Automotive equipment rental and leasing	Automotive repair and maintenance	Electric power generation, transmission, and distribution
5. Cap 50+CP-Half		
Top 3 Positive Impact		
Offices of health practitioners	Household appliance manufacturing	Automotive repair and maintenance
Real estate	Ventilation, heating, air-conditioning, and commercial refrigeration equipment manufacturing	Truck transportation
Electric power generation, transmission, and distribution	Nonmetallic mineral mining and quarrying	Monetary authorities, credit intermediation
Top 3 Negative Impact		
Automotive repair and maintenance	Retail trade	Real estate
Oil and gas extraction	Construction	Construction

Wholesale trade	Real estate	Electric power generation, transmission, and distribution
6. Cap 5+CP-HP		
Top 3 Positive Impact		
Offices of health practitioners	Offices of health practitioners	Offices of health practitioners
Real estate	Real estate	Retail trade
Telecommunications	Telecommunications	Monetary authorities, credit intermediation
Top 3 Negative Impact		
Electric power generation, transmission, and distribution	Electric power generation, transmission, and distribution	Electric power generation, transmission, and distribution
Automotive repair and maintenance	Construction	Petroleum refining
Wholesale trade	Petroleum refining	Construction
7. Cap 20+CP-HP		
Top 3 Positive Impact		
Offices of health practitioners	Offices of health practitioners	Offices of health practitioners
Real estate	Hospitals	Retail trade
Telecommunications	Telecommunications	Automotive repair and maintenance
Top 3 Negative Impact		
Automotive repair and maintenance	Electric power generation, transmission, and distribution	Electric power generation, transmission, and distribution
Electric power generation, transmission, and distribution	Construction	Petroleum refining
Oil and gas extraction	Petroleum refining	Construction

Table B2. Major Sectoral Impacts of WCI Policy Scenarios
(top 3 positive and negative impacted sectors in terms of percentage GSP impacts)

2012	2015	2020
1. Complementary		
Top 3 Positive Impact		
Personal care services	Household appliance manufacturing	Household appliance manufacturing
Other furniture related product manufacturing	Personal care services	Personal care services
Offices of health practitioners	Other furniture related product manufacturing	Private households
Top 3 Negative Impact		
Forestry; Fishing, hunting, trapping	Forestry; Fishing, hunting, trapping	Forestry; Fishing, hunting, trapping
Automotive repair and maintenance	Automotive repair and maintenance	Coal mining
Automotive equipment rental and leasing	Coal mining	Petroleum refining
2. Cap 5+CP		
Top 3 Positive Impact		
Personal care services	Household appliance manufacturing	Household appliance manufacturing
Other furniture related product manufacturing	Personal care services	Personal care services
Offices of health practitioners	Other furniture related product manufacturing	Private households
Top 3 Negative Impact		
Forestry; Fishing, hunting, trapping	Forestry; Fishing, hunting, trapping	Forestry; Fishing, hunting, trapping
Automotive repair and maintenance	Automotive repair and maintenance	Coal mining
Automotive equipment rental and leasing	Coal mining	Petroleum refining

3. Cap 20+CP		
Top 3 Positive Impact		
Personal care services	Household appliance manufacturing	Household appliance manufacturing
Other furniture related product manufacturing	Personal care services	Private households
Offices of health practitioners	Private households	Automotive repair and maintenance
Top 3 Negative Impact		
Forestry; Fishing, hunting, trapping	Forestry; Fishing, hunting, trapping	Forestry; Fishing, hunting, trapping
Automotive repair and maintenance	Automotive repair and maintenance	Petroleum refining
Automotive equipment rental and leasing	Automotive equipment rental and leasing	Motor vehicle manufacturing
4. Cap 40+CP		
Top 3 Positive Impact		
Personal care services	Household appliance manufacturing	Household appliance manufacturing
Other furniture related product manufacturing	Personal care services	Automotive repair and maintenance
Offices of health practitioners	Private households	Private households
Top 3 Negative Impact		
Forestry; Fishing, hunting, trapping	Forestry; Fishing, hunting, trapping	Forestry; Fishing, hunting, trapping
Automotive repair and maintenance	Automotive repair and maintenance	Petroleum refining
Automotive equipment rental and leasing	Automotive equipment rental and leasing	Motor vehicle manufacturing
5. Cap 50+CP-Half		
Top 3 Positive Impact		
Personal care services	Household appliance manufacturing	Automotive repair and maintenance

Other furniture related product manufacturing	Ventilation, heating, air-conditioning, and commercial refrigeration equipment manufacturing	Household appliance manufacturing
Offices of health practitioners	Agriculture, construction, and mining machinery manufacturing	Automotive equipment rental and leasing
Top 3 Negative Impact		
Forestry; Fishing, hunting, trapping	Forestry; Fishing, hunting, trapping	Forestry; Fishing, hunting, trapping
Automotive repair and maintenance	Automotive repair and maintenance	Petroleum refining
Engine, turbine, power transmission equipment mfg	Automotive equipment rental and leasing	Pulp, paper, and paperboard mills
6. Cap 5+CP-HighPrice		
Top 3 Positive Impact		
Personal care services	Household appliance manufacturing	Household appliance manufacturing
Other furniture related product manufacturing	Personal care services	Personal care services
Offices of health practitioners	Private households	Private households
Top 3 Negative Impact		
Engine, turbine, power transmission equipment manufacturing	Forestry; Fishing, hunting, trapping	Petroleum refining
Forestry; Fishing, hunting, trapping	Petroleum refining	Forestry; Fishing, hunting, trapping
Automotive repair and maintenance	Automotive repair and maintenance	Electric power generation, transmission, and distribution
7. Cap 20+CP- HighPrice		
Top 3 Positive Impact		
Personal care services	Household appliance manufacturing	Household appliance manufacturing
Other furniture related product	Personal care services	Automotive repair and

manufacturing		maintenance
Offices of health practitioners	Private households	Private households
Top 3 Negative Impact		
Engine, turbine, power transmission equipment manufacturing	Forestry; Fishing, hunting, trapping	Petroleum refining
Forestry; Fishing, hunting, trapping	Petroleum refining	Forestry; Fishing, hunting, trapping
Automotive repair and maintenance	Automotive repair and maintenance	Electric power generation, transmission, and distribution

Appendix C. New Mexico Detailed Simulation Results

Complementary Policies Case

Differences from Baseline

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	NPV 2010-2020
Total Employment	Thousands (Jobs)	0.819	1.312	1.367	1.242	1.087	0.911	0.710	1.134	1.592	2.177	2.579	N/A
Gross Domestic Product	Billions of Fixed (2008) Dollars	0.057	0.088	0.088	0.082	0.073	0.062	0.047	0.059	0.084	0.126	0.150	0.674
Output	Billions of Fixed (2008) Dollars	0.071	0.110	0.105	0.091	0.072	0.049	0.023	0.038	0.068	0.127	0.150	0.676
Population	Thousands	0.354	0.592	0.787	0.915	0.967	0.943	0.844	0.823	0.879	1.028	1.232	N/A
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	0.026	0.043	0.040	0.033	0.023	0.011	-0.003	-0.005	-0.003	0.006	0.014	0.157
PCE-Price Index	2000=100 (Nation)	0.003	0.005	0.019	0.031	0.047	0.064	0.084	0.103	0.124	0.151	0.166	N/A

Levels

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Employment	Thousands (Jobs)	1,086.4	1,094.8	1,108.3	1,122.0	1,135.9	1,147.8	1,158.6	1,169.4	1,177.9	1,193.2	1,203.7
Gross Domestic Product	Billions of Fixed (2008) Dollars	69.5	71.1	72.7	74.3	76.0	77.7	79.4	81.1	82.6	84.7	86.5
Output	Billions of Fixed (2008) Dollars	93.7	96.4	99.0	101.7	104.4	107.1	109.9	112.8	115.5	119.0	122.1
Population	Thousands	2,057.6	2,088.9	2,120.6	2,152.4	2,184.5	2,216.7	2,249.0	2,281.6	2,313.8	2,346.9	2,380.6
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	57.6	58.8	60.1	61.5	62.9	64.4	65.8	67.1	68.3	69.6	70.8
PCE-Price Index	2000=100 (Nation)	132.7	136.2	140.0	144.1	148.3	152.8	157.4	162.4	167.5	172.8	178.2

Percent Change

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Employment	Thousands (Jobs)	0.08%	0.12%	0.12%	0.11%	0.10%	0.08%	0.06%	0.10%	0.14%	0.18%	0.21%
Gross Domestic Product	Billions of Fixed (2008) Dollars	0.08%	0.12%	0.12%	0.11%	0.10%	0.08%	0.06%	0.07%	0.10%	0.15%	0.17%
Output	Billions of Fixed (2008) Dollars	0.08%	0.11%	0.11%	0.09%	0.07%	0.05%	0.02%	0.03%	0.06%	0.11%	0.12%
Population	Thousands	0.02%	0.03%	0.04%	0.04%	0.04%	0.04%	0.04%	0.04%	0.04%	0.04%	0.05%
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	0.05%	0.07%	0.07%	0.05%	0.04%	0.02%	0.00%	-0.01%	0.00%	0.01%	0.02%
PCE-Price Index	2000=100 (Nation)	0.00%	0.00%	0.01%	0.02%	0.03%	0.04%	0.05%	0.06%	0.07%	0.09%	0.09%

Cap 5+CP Case

Differences from Baseline

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	NPV 2010-2020
Total Employment	Thousands (Jobs)	0.823	1.311	1.354	1.227	0.824	0.584	0.388	0.792	1.235	1.787	2.171	N/A
Gross Domestic Product	Billions of Fixed (2008) Dollars	0.057	0.088	0.088	0.082	0.055	0.038	0.021	0.031	0.054	0.091	0.112	0.542
Output	Billions of Fixed (2008) Dollars	0.072	0.110	0.103	0.089	0.047	0.016	-0.013	-0.003	0.025	0.077	0.096	0.488
Population	Thousands	0.354	0.592	0.788	0.920	0.906	0.811	0.647	0.563	0.557	0.642	0.782	N/A
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	0.026	0.043	0.040	0.034	0.014	0.000	-0.015	-0.019	-0.018	-0.011	-0.005	0.093
PCE-Price Index	2000=100 (Nation)	0.003	0.005	0.016	0.027	0.052	0.069	0.089	0.107	0.129	0.156	0.172	N/A

Levels

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Employment	Thousands (Jobs)	1,086.4	1,094.8	1,108.3	1,122.0	1,135.7	1,147.5	1,158.3	1,169.0	1,177.6	1,192.8	1,203.3
Gross Domestic Product	Billions of Fixed (2008) Dollars	69.5	71.1	72.7	74.3	75.9	77.6	79.4	81.0	82.5	84.7	86.5
Output	Billions of Fixed (2008) Dollars	93.7	96.4	99.0	101.7	104.4	107.1	109.9	112.8	115.4	118.9	122.1
Population	Thousands	2,057.6	2,088.9	2,120.6	2,152.4	2,184.4	2,216.6	2,248.8	2,281.3	2,313.5	2,346.5	2,380.1
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	57.6	58.8	60.1	61.5	62.9	64.4	65.8	67.1	68.2	69.6	70.8
PCE-Price Index	2000=100 (Nation)	132.7	136.2	140.0	144.1	148.3	152.8	157.4	162.4	167.5	172.8	178.2

Percent Change

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Employment	Thousands (Jobs)	0.08%	0.12%	0.12%	0.11%	0.07%	0.05%	0.03%	0.07%	0.11%	0.15%	0.18%
Gross Domestic Product	Billions of Fixed (2008) Dollars	0.08%	0.12%	0.12%	0.11%	0.07%	0.05%	0.03%	0.04%	0.07%	0.11%	0.13%
Output	Billions of Fixed (2008) Dollars	0.08%	0.11%	0.10%	0.09%	0.04%	0.02%	-0.01%	0.00%	0.02%	0.07%	0.08%
Population	Thousands	0.02%	0.03%	0.04%	0.04%	0.04%	0.04%	0.03%	0.03%	0.02%	0.03%	0.03%
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	0.05%	0.07%	0.07%	0.06%	0.02%	0.00%	-0.02%	-0.03%	-0.03%	-0.02%	-0.01%
PCE-Price Index	2000=100 (Nation)	0.00%	0.00%	0.01%	0.02%	0.04%	0.05%	0.06%	0.07%	0.08%	0.09%	0.10%

Cap 20+CP Case

Differences from Baseline

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	NPV 2010-2020
Total Employment	Thousands (Jobs)	0.828	1.321	1.423	1.266	0.083	-0.100	-0.343	-0.097	0.169	0.488	0.744	N/A
Gross Domestic Product	Billions of Fixed (2008) Dollars	0.057	0.088	0.093	0.083	0.004	-0.008	-0.037	-0.043	-0.040	-0.029	-0.021	0.169
Output	Billions of Fixed (2008) Dollars	0.072	0.111	0.115	0.094	-0.028	-0.033	-0.079	-0.092	-0.097	-0.089	-0.091	0.010
Population	Thousands	0.357	0.596	0.806	0.941	0.710	0.427	0.081	-0.208	-0.443	-0.619	-0.746	N/A
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	0.026	0.043	0.042	0.034	-0.020	-0.038	-0.058	-0.069	-0.076	-0.079	-0.081	-0.149
PCE-Price Index	2000=100 (Nation)	0.003	0.005	0.020	0.031	0.084	0.114	0.137	0.159	0.181	0.206	0.222	N/A

Levels

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Employment	Thousands (Jobs)	1,086.4	1,094.8	1,108.3	1,122.0	1,134.9	1,146.8	1,157.6	1,168.1	1,176.5	1,191.5	1,201.9
Gross Domestic Product	Billions of Fixed (2008) Dollars	69.5	71.1	72.7	74.3	75.9	77.6	79.3	81.0	82.4	84.5	86.3
Output	Billions of Fixed (2008) Dollars	93.7	96.4	99.1	101.7	104.3	107.0	109.8	112.7	115.3	118.8	121.9
Population	Thousands	2,057.6	2,088.9	2,120.6	2,152.5	2,184.2	2,216.2	2,248.2	2,280.5	2,312.5	2,345.3	2,378.6
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	57.6	58.8	60.1	61.5	62.9	64.3	65.7	67.0	68.2	69.5	70.7
PCE-Price Index	2000=100 (Nation)	132.7	136.2	140.0	144.1	148.4	152.8	157.5	162.5	167.5	172.8	178.3

Percent Change

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Employment	Thousands (Jobs)	0.08%	0.12%	0.13%	0.11%	0.01%	-0.01%	-0.03%	-0.01%	0.01%	0.04%	0.06%
Gross Domestic Product	Billions of Fixed (2008) Dollars	0.08%	0.13%	0.13%	0.11%	0.01%	-0.01%	-0.05%	-0.05%	-0.05%	-0.04%	-0.02%
Output	Billions of Fixed (2008) Dollars	0.08%	0.12%	0.12%	0.09%	-0.03%	-0.03%	-0.07%	-0.08%	-0.08%	-0.08%	-0.08%
Population	Thousands	0.02%	0.03%	0.04%	0.04%	0.03%	0.02%	0.00%	-0.01%	-0.02%	-0.03%	-0.03%
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	0.05%	0.07%	0.07%	0.06%	-0.03%	-0.06%	-0.09%	-0.10%	-0.11%	-0.11%	-0.11%
PCE-Price Index	2000=100 (Nation)	0.00%	0.00%	0.01%	0.02%	0.06%	0.07%	0.09%	0.10%	0.11%	0.12%	0.13%

Cap 40+CP Case

Differences from Baseline

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	NPV 2010-2020
Total Employment	Thousands (Jobs)	0.823	1.311	1.638	1.463	-0.719	-1.433	-1.668	-1.472	-1.247	-0.957	-0.763	N/A
Gross Domestic Product	Billions of Fixed (2008) Dollars	0.057	0.088	0.113	0.100	-0.048	-0.108	-0.142	-0.155	-0.159	-0.151	-0.152	-0.295
Output	Billions of Fixed (2008) Dollars	0.072	0.110	0.155	0.131	-0.088	-0.176	-0.229	-0.255	-0.267	-0.267	-0.282	-0.628
Population	Thousands	0.354	0.592	0.850	1.022	0.535	-0.085	-0.741	-1.317	-1.824	-2.252	-2.637	N/A
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	0.026	0.043	0.048	0.039	-0.060	-0.094	-0.122	-0.137	-0.147	-0.154	-0.161	-0.444
PCE-Price Index	2000=100 (Nation)	0.003	0.005	0.026	0.040	0.137	0.154	0.183	0.202	0.227	0.250	0.276	N/A

Levels

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Employment	Thousands (Jobs)	1,086.4	1,094.8	1,108.5	1,122.2	1,134.1	1,145.5	1,156.3	1,166.8	1,175.1	1,190.1	1,200.4
Gross Domestic Product	Billions of Fixed (2008) Dollars	69.5	71.1	72.7	74.3	75.8	77.5	79.2	80.8	82.3	84.4	86.2
Output	Billions of Fixed (2008) Dollars	93.7	96.4	99.1	101.7	104.2	106.9	109.7	112.5	115.1	118.6	121.7
Population	Thousands	2,057.6	2,088.9	2,120.7	2,152.5	2,184.1	2,215.7	2,247.4	2,279.4	2,311.1	2,343.7	2,376.7
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	57.6	58.8	60.2	61.5	62.9	64.3	65.7	66.9	68.1	69.5	70.6
PCE-Price Index	2000=100 (Nation)	132.7	136.2	140.0	144.1	148.4	152.9	157.5	162.5	167.6	172.9	178.3

Percent Change

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Employment	Thousands (Jobs)	0.08%	0.12%	0.15%	0.13%	-0.06%	-0.13%	-0.14%	-0.13%	-0.11%	-0.08%	-0.06%
Gross Domestic Product	Billions of Fixed (2008) Dollars	0.08%	0.12%	0.16%	0.13%	-0.06%	-0.14%	-0.18%	-0.19%	-0.19%	-0.18%	-0.18%
Output	Billions of Fixed (2008) Dollars	0.08%	0.11%	0.16%	0.13%	-0.08%	-0.17%	-0.21%	-0.23%	-0.23%	-0.23%	-0.23%
Population	Thousands	0.02%	0.03%	0.04%	0.05%	0.03%	0.00%	-0.03%	-0.06%	-0.08%	-0.10%	-0.11%
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	0.05%	0.07%	0.08%	0.06%	-0.10%	-0.15%	-0.19%	-0.20%	-0.22%	-0.22%	-0.23%
PCE-Price Index	2000=100 (Nation)	0.00%	0.00%	0.02%	0.03%	0.09%	0.10%	0.12%	0.13%	0.14%	0.15%	0.16%

Cap 50+CP-Half Case

Differences from Baseline

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	NPV 2010-2020
Total Employment	Thousands (Jobs)	0.491	0.720	0.886	0.627	-2.152	-3.088	-3.429	-3.421	-3.321	-3.115	-3.109	N/A
Gross Domestic Product	Billions of Fixed (2008) Dollars	0.037	0.052	0.071	0.053	-0.135	-0.213	-0.258	-0.289	-0.306	-0.310	-0.330	-1.038
Output	Billions of Fixed (2008) Dollars	0.048	0.066	0.102	0.076	-0.199	-0.311	-0.378	-0.430	-0.465	-0.478	-0.523	-1.591
Population	Thousands	0.232	0.360	0.500	0.538	-0.229	-1.145	-2.092	-2.974	-3.787	-4.517	-5.217	N/A
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	0.016	0.024	0.028	0.014	-0.112	-0.154	-0.189	-0.213	-0.229	-0.242	-0.258	-0.856
PCE-Price Index	2000=100 (Nation)	0.002	0.003	0.016	0.034	0.149	0.164	0.195	0.212	0.234	0.262	0.284	N/A

Levels

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Employment	Thousands (Jobs)	1,086.0	1,094.2	1,107.8	1,121.4	1,132.7	1,143.8	1,154.5	1,164.8	1,173.0	1,187.9	1,198.0
Gross Domestic Product	Billions of Fixed (2008) Dollars	69.5	71.1	72.7	74.3	75.8	77.4	79.1	80.7	82.2	84.3	86.0
Output	Billions of Fixed (2008) Dollars	93.7	96.4	99.0	101.7	104.1	106.8	109.5	112.3	114.9	118.4	121.5
Population	Thousands	2,057.5	2,088.7	2,120.3	2,152.1	2,183.3	2,214.7	2,246.1	2,277.8	2,309.2	2,341.4	2,374.1
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	57.6	58.8	60.1	61.5	62.8	64.2	65.6	66.9	68.0	69.4	70.5
PCE-Price Index	2000=100 (Nation)	132.7	136.2	140.0	144.1	148.4	152.9	157.5	162.5	167.6	172.9	178.4

Percent Change

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Employment	Thousands (Jobs)	0.05%	0.07%	0.08%	0.06%	-0.19%	-0.27%	-0.30%	-0.29%	-0.28%	-0.26%	-0.26%
Gross Domestic Product	Billions of Fixed (2008) Dollars	0.05%	0.07%	0.10%	0.07%	-0.18%	-0.27%	-0.33%	-0.36%	-0.37%	-0.37%	-0.38%
Output	Billions of Fixed (2008) Dollars	0.05%	0.07%	0.10%	0.07%	-0.19%	-0.29%	-0.34%	-0.38%	-0.40%	-0.40%	-0.43%
Population	Thousands	0.01%	0.02%	0.02%	0.03%	-0.01%	-0.05%	-0.09%	-0.13%	-0.16%	-0.19%	-0.22%
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	0.03%	0.04%	0.05%	0.02%	-0.18%	-0.24%	-0.29%	-0.32%	-0.34%	-0.35%	-0.36%
PCE-Price Index	2000=100 (Nation)	0.00%	0.00%	0.01%	0.02%	0.10%	0.11%	0.12%	0.13%	0.14%	0.15%	0.16%

Cap 5+CP-HighPrice Case

Differences from Baseline

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	NPV 2010-2020
Total Employment	Thousands (Jobs)	1.021	1.409	1.254	0.706	-0.001	-0.753	-1.436	-1.457	-1.224	-0.954	-0.721	N/A
Gross Domestic Product	Billions of Fixed (2008) Dollars	0.079	0.100	0.071	0.014	-0.050	-0.136	-0.220	-0.277	-0.302	-0.326	-0.363	-0.855
Output	Billions of Fixed (2008) Dollars	0.163	0.166	0.105	-0.025	-0.142	-0.317	-0.503	-0.641	-0.722	-0.815	-0.918	-2.267
Population	Thousands	0.399	0.651	0.808	0.804	0.600	0.227	-0.281	-0.762	-1.157	-1.470	-1.712	N/A
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	0.035	0.045	0.033	0.006	-0.028	-0.064	-0.100	-0.123	-0.132	-0.137	-0.141	-0.368
PCE-Price Index	2000=100 (Nation)	0.004	0.008	0.026	0.044	0.071	0.086	0.099	0.114	0.125	0.136	0.138	N/A

Levels

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Employment	Thousands (Jobs)	1,086.6	1,094.9	1,108.2	1,121.5	1,134.9	1,146.2	1,156.5	1,166.8	1,175.1	1,190.1	1,200.4
Gross Domestic Product	Billions of Fixed (2008) Dollars	69.5	71.1	72.7	74.2	75.8	77.5	79.1	80.7	82.2	84.2	86.0
Output	Billions of Fixed (2008) Dollars	93.8	96.5	99.0	101.6	104.2	106.8	109.4	112.1	114.7	118.0	121.1
Population	Thousands	2,057.7	2,089.0	2,120.6	2,152.3	2,184.1	2,216.0	2,247.9	2,280.0	2,311.8	2,344.4	2,377.6
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	57.6	58.8	60.1	61.4	62.9	64.3	65.7	67.0	68.1	69.5	70.7
PCE-Price Index	2000=100 (Nation)	132.7	136.2	140.0	144.1	148.4	152.8	157.5	162.4	167.5	172.8	178.2

Percent Change

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Employment	Thousands (Jobs)	0.09%	0.13%	0.11%	0.06%	0.00%	-0.07%	-0.12%	-0.13%	-0.10%	-0.08%	-0.06%
Gross Domestic Product	Billions of Fixed (2008) Dollars	0.11%	0.14%	0.10%	0.02%	-0.07%	-0.18%	-0.28%	-0.34%	-0.37%	-0.39%	-0.42%
Output	Billions of Fixed (2008) Dollars	0.17%	0.17%	0.11%	-0.03%	-0.14%	-0.30%	-0.46%	-0.57%	-0.63%	-0.69%	-0.75%
Population	Thousands	0.02%	0.03%	0.04%	0.04%	0.03%	0.01%	-0.01%	-0.03%	-0.05%	-0.06%	-0.07%
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	0.06%	0.08%	0.05%	0.01%	-0.05%	-0.10%	-0.15%	-0.18%	-0.19%	-0.20%	-0.20%
PCE-Price Index	2000=100 (Nation)	0.00%	0.01%	0.02%	0.03%	0.05%	0.06%	0.06%	0.07%	0.08%	0.08%	0.08%

Cap 20+CP-HighPrice Case

Differences from Baseline

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	NPV 2010-2020
Total Employment	Thousands (Jobs)	1.021	1.409	1.318	1.011	-0.510	-1.526	-2.234	-2.325	-2.303	-2.110	-2.047	N/A
Gross Domestic Product	Billions of Fixed (2008) Dollars	0.079	0.100	0.078	0.043	-0.079	-0.189	-0.281	-0.346	-0.394	-0.428	-0.481	-1.167
Output	Billions of Fixed (2008) Dollars	0.163	0.166	0.117	0.029	-0.175	-0.387	-0.583	-0.733	-0.853	-0.959	-1.087	-2.680
Population	Thousands	0.399	0.651	0.834	0.903	0.534	-0.046	-0.748	-1.421	-2.047	-2.578	-3.073	N/A
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	0.035	0.045	0.037	0.018	-0.053	-0.098	-0.140	-0.166	-0.185	-0.194	-0.209	-0.567
PCE-Price Index	2000=100 (Nation)	0.004	0.009	0.022	0.047	0.103	0.118	0.134	0.148	0.162	0.169	0.181	N/A

Levels

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Employment	Thousands (Jobs)	1,086.6	1,094.9	1,108.2	1,121.8	1,134.3	1,145.4	1,155.7	1,165.9	1,174.0	1,188.9	1,199.1
Gross Domestic Product	Billions of Fixed (2008) Dollars	69.5	71.1	72.7	74.3	75.8	77.4	79.1	80.7	82.1	84.1	85.9
Output	Billions of Fixed (2008) Dollars	93.8	96.5	99.1	101.6	104.1	106.7	109.3	112.0	114.6	117.9	120.9
Population	Thousands	2,057.7	2,089.0	2,120.6	2,152.4	2,184.1	2,215.8	2,247.4	2,279.3	2,310.9	2,343.3	2,376.3
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	57.6	58.8	60.1	61.5	62.9	64.3	65.7	66.9	68.1	69.4	70.6
PCE-Price Index	2000=100 (Nation)	132.7	136.2	140.0	144.1	148.4	152.8	157.5	162.5	167.5	172.8	178.3

Percent Change

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Employment	Thousands (Jobs)	0.09%	0.13%	0.12%	0.09%	-0.05%	-0.13%	-0.19%	-0.20%	-0.20%	-0.18%	-0.17%
Gross Domestic Product	Billions of Fixed (2008) Dollars	0.11%	0.14%	0.11%	0.06%	-0.11%	-0.24%	-0.36%	-0.43%	-0.48%	-0.51%	-0.56%
Output	Billions of Fixed (2008) Dollars	0.17%	0.17%	0.12%	0.03%	-0.17%	-0.36%	-0.53%	-0.65%	-0.74%	-0.81%	-0.89%
Population	Thousands	0.02%	0.03%	0.04%	0.04%	0.02%	0.00%	-0.03%	-0.06%	-0.09%	-0.11%	-0.13%
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	0.06%	0.08%	0.06%	0.03%	-0.08%	-0.15%	-0.21%	-0.25%	-0.27%	-0.28%	-0.30%
PCE-Price Index	2000=100 (Nation)	0.00%	0.01%	0.02%	0.03%	0.07%	0.08%	0.09%	0.09%	0.10%	0.10%	0.10%

MACROECONOMIC IMPACTS OF THE NEW MEXICO CAP-AND-TRADE PROGRAM ON THE STATE'S ECONOMY: A REMI ANALYSIS

by

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Final Report to

New Mexico Environment Department
Santa Fe, NM

July 13, 2010

MACROECONOMIC IMPACTS OF THE NEW MEXICO CAP-AND-TRADE PROGRAM ON THE STATE'S ECONOMY: A REMI ANALYSIS

Adam Rose, Dan Wei and Steve Miller[1]

Adam Rose and Associates

July 13, 2010

Executive Summary

This report presents the results of the application of the Regional Economic Models, Inc., Policy Insight Plus (REMI PI+) Model to measure the impacts of the New Mexico Cap-and-Trade Program on the State's economy.

The New Mexico Environment Department (NMED) is proposing rules to enable the state to participate in a regional greenhouse gas (GHG) cap-and-trade program through the Western Climate Initiative (WCI) beginning in 2012. The WCI is a coalition of seven U.S. states and four Canadian provinces working together to identify, evaluate and implement policies to address climate change, including a regional GHG cap-and-trade program. The WCI established a regional GHG emission reduction target and identified policy options to achieve the target. The WCI emission reduction target is consistent with that established for New Mexico by Governor Richardson. In 2009, the WCI commissioned ICF International, Inc. (ICF) to help them conduct an analysis of direct economic impacts of its proposals to better understand its policy choices.

The purpose of this report is to estimate the economy-wide impacts on New Mexico of the WCI climate change policies. This analysis uses data from ICF's Phase 3 WCI economic modeling results and the New Mexico Environment Department to simulate the direct and indirect (macroeconomic) economic impacts of several policy cases. The REMI Model was chosen for a combination of reasons pertaining to accuracy, cost, and manageability.

SUMMARY OF KEY FINDINGS

Following a description of the policy cases, we present the impacts of each policy case on macroeconomic indicators of gross state product (GSP), income, and employment, as well as the impacts on energy prices. The results are presented for the key years of planning horizon and 169 economic sectors. Also, net present value measures are presented for GSP and income.

The results indicate that most of the scenarios would have a very small negative impact on the State's economy by Year 2020, though two of the cases yield slightly positive impacts. In fact, these are the cases that are most likely to transpire, because they most closely resemble the NM policy proposal of a combination of complementary polices plus cap and trade, but with free-granting of allowances.

[1] We wish to thank Janie Chermak, Karl Hausker, and Paul Cross for their help in providing the data for the ENERGY 2020 simulations. We also appreciate the helpful guidance of Sandra Ely and members of her staff in identifying the relevant simulations. Of course, any errors or omissions in this report are solely the responsibility of the authors.

The Regional Economic Models, Inc, Policy Insight Plus (REMI PI+) Model is used to undertake the analysis of the impacts to the WCI Policy Case on the New Mexico economy. The REMI Model was chosen for a combination of reasons pertaining to accuracy, cost, and manageability. The study is based on data obtained from the State of New Mexico Environment Department and ICF, on simulations of direct economic impacts of these policies. We then applied the REMI PI+ model to estimate various types of indirect, or macroeconomic, impacts. Details of the input data can be found in ICF (2010). Documentation of the REMI Model in general and its applications can be found in REMI (2010) and Rose and Wei (2010a) and Miller et al. (2010), and for this particular study in Rose and Wei (2010b). Note that the 169-sector NM REMI PI+ Model was first recalibrated with New Mexico data and ENERGY 2020 data to be consistent with this application.

Seven policy cases consistent with the simulations performed by ICF were used in the REMI PI+ Model. These cases varied according to effectiveness of the complementary policies, background considerations, and assumptions about emissions allowance prices. Allowances prices were taken from the ENERGY 2020 results. The seven cases are described below:

1. Aggregated Complementary Policies case: Complementary policies are often adopted in conjunction with the Cap-and-Trade (C&T) program. These policies are identified to promote emission reductions that are not responsive to price signals. In the WCI program, three complementary policies are included in the analysis. They are Clean Car Standards, Energy Efficiency, and Vehicle Miles Traveled (please see ICF (2010) for the details on the timing and target of these three complementary policies). In this policy case, we evaluate the macroeconomic impacts of a combination of these three complementary policies in NM alone. This means we exclude any policies that may come under the C&T program in this policy case analysis. In addition, this case assumes that all of the three complementary policies will be implemented at full effectiveness. Variation in the assumptions about the effectiveness of these policies will be addressed in Case 5 below.

2. Cap 5+CP case (Cap &Trade (C&T) plus complementary policies: $5 allowance price): Cases 2 to 4 correspond to the Main Policy Case in the WCI analysis. The Cap 5+CP case evaluates the impacts of the WCI C&T program in conjunction with the three complementary policies on the NM economy. The primary set of Economic Modeling Team (EMT) assumptions on future socio-economic conditions is adopted in this case. In this case, the ENERGY 2020 model assumes that the allowance price in Year 2020 is $5/ton, which is the lowest allowance price ICF analyzed for the Main Policy Case. As a result this is the policy case that is the closest approximation to the free-granting case. .

3. Cap 20+CP case (C&T plus complementary policies: $20 allowance price): In the WCI analysis, the equilibrium allowance price of the Main Policy Case is $33/ton. Therefore, we analyzed $20/ton and $40/ton allowance price scenarios as sensitivity bounds for the Main Policy Case in this case and the following one. The $20/ton price is the lower bound for the allowance price.

4. Cap 40+CP case (C&T plus complementary policies: $40 allowance price): This is the upper-bound sensitivity case for the $33/ton allowance price of the Main Policy Case.

5. Cap 50+CP-Half case (C&T with Vehicle Miles Traveled (VMT) and Energy efficiency (EE) options cut in Half: $50 allowance price): This is the sensitivity case on the effectiveness of the complementary policies. This case assumes that only half of the emission reduction target of energy efficiency and VMT can be achieved. It assumes that the third complementary policy, Clean Car Standards, can still achieve its full emission reductions. The WCI analysis indicates an allowance price of at least $50/ton for mitigation compliance of the whole region in this case. Therefore, we analyzed the $50/ton allowance price scenario for this policy case.

6. Cap 5+CP-HighPrice case (C&T with 50% Increase in Energy Prices and 30% Higher Construction Costs: $5 allowance price): This and the following case assume that energy prices will increase in real terms by 50% by 2020 compared with the 2008 prices. The capital cost and the O&M cost for power generation are assumed to be 30% higher than in the Main Policy Case. Both of these price assumptions are intended to provide reasonable upper bounds for key prices in the estimates. In the WCI analysis, the equilibrium allowance price of the High Price Case is $13/ton. Therefore, the $5/ton scenario represents our lower-bound sensitivity case for the allowance price.

7. Cap 20+CP-HighPrice case (C&T with 50% Increase in Energy Prices and 30% Higher Construction Costs: $20 allowance price): The $20/ton scenario represents our upper-bound sensitivity case for the allowance price of the High Price Policy Case.

DISCUSSION

Table ES1 summarizes the projected impacts of each policy case on macroeconomic indicators of gross state product (GSP), income, and employment, and Table ES2 summarizes the impacts on energy prices. The results are presented for key years of planning horizon and 169 economic sectors. Also, net present value measures are presented for GSP and income. Note, however, that the employment impacts can't be summed over the time horizon, because employment impact estimates for a given year are already cumulative up to a given date, i.e., the employment change in Year 2016 continues in 2017 plus any addition or deletion of jobs between the two years.

The policy case analyses described below are conservative in terms of the conditions affecting likely impacts. New Mexico intends to freely grant allowances, but the WCI policy cases assume that allowances will be auctioned. In the auction scenario, out of pocket expenditures to purchase allowances will increase the emitters' cost of production, and they will attempt to pass on these cost increases in the form of higher prices to their customers. This, in turn increases the cost of production in other businesses, and continues through successive rounds of ripples of cost-push inflation. Moreover, it decreases the purchasing power of household income. All of this comes together to yield more negative impacts than otherwise. In New Mexico, however, the current policy proposal is not to auction allowances but to freely grant them. Thus, there should be no price pressures from the cap and trade aspect for the freely allocated allowances.

The ENERGY 2020 Model did not simulate the free granting of allowances. We can, however, interpolate it as falling somewhere between the Complementary Policies case (which contains no allowance trading) and the Cap 5+CP case (Cases 1 and 2 in Table ES-1). Both of these yield positive impacts on the New Mexico economy in all respects. Therefore, our best estimate of the impacts of the proposed implementation of the free allocation of allowances on New Mexico is a slightly positive impact on the order of approximately one-tenth of 1 percent (0.001) on major economic indicators over the course of the planning horizon and in the terminal Year 2020. The positive impacts stem primarily from cost-saving mitigation options associated with the proposed policies, primarily in the form of savings from energy efficiency and transportation/land use policies throughout the horizon, and the increasing attractiveness of renewable electricity, as their technological costs decline with experience and improvements in economies of scale, as well as the increase in prices of non-renewable fossil fuels in the baseline.

The results indicate that the remaining scenarios (Cases 3-7) would have very small negative impacts on the State's economy by Year 2020. However, these cases are the less likely outcomes that would transpire. This is because the ENERGY 2020 model assumes that 100% of the allowances will be auctioned and the allowance costs will be automatically passed through onto the energy consumers. However, NM proposes to allocate all the allowances freely, so there will be no additional cost pressures.

Therefore, the lowest allowance price scenario of the Main Policy Case best resembles the likely policy case in NM.

The following is a brief summary of the results for of each policy case:

1. Aggregated complementary policies. This case has the strongest positive impact on the New Mexico economy. We project an increase of $674 million dollars in net present value (time-discounted) terms over the planning horizon 2010-2020. The impacts are positive in the Year 2020 itself. The increase in gross state product (GSP) of 0.17 percent of economic activity translates into an increase of $150 million in GSP. Employment gains in the Year 2020 are over 2.5 thousand jobs in terms of person-year equivalents, or a 0.22 percent increase over baseline. The positive impacts stem primarily from cost savings associated with energy efficiency and reduced costs of transportation. Note that this case results in GHG emissions of 72.10 MMTCO2e in the Year 2020 before evaluation of the macro impacts. This exceeds the cap of 63.99 MMTCO2e for that year by 12.7%. Taking macro impacts in to consideration, the projected emissions reduce to 72.0, or 12.5% above the cap. The slight reduction in emissions due to macro impacts reduces emissions despite an increase in overall economic activity. This is due to improvements in energy efficiency and shifts to less-carbon intensive products.

2. Cap 5+CP (C&T plus complimentary policies: $5 allowance price): This case yields positive impacts about 80% the size of Case 1. It differs from Case 1 only in that it adds a cap-and-trade feature, though this has only a minimal dampening influence because the allowance price is so low.

3. Cap 20+CP (C&T plus complimentary policies: $20 allowance price). This case also yields a positive impact, though it is extremely small over the entire planning horizon. The employment increase is only 0.06 percent, and in fact the GSP impact turns slightly negative by Year 2020. The impacts of this case are not as attractive as the previous one because of the higher allowance price.

4. Cap 40+CP (C&T plus complimentary policies: $40 allowance price). This case yields uniformly negative impacts on the New Mexico economy, though they are still rather small. The GSP impact in the Year 2020 is -0.18 percent, and the employment loss in that year is -0.06 percent.

5. Cap 50+CP-Half (C&T with VMT and EE policies at half the previous levels: $50 allowance price). In this case, the negative impacts grow significantly, with GSP declining by 0.38 percent and employment declining by 0.26 percent, or slightly more than 3,000 jobs, from the referent case in the Year 2020. In terms of employment, this is the worst-case scenario. This case also yields the most negative GSP impacts in the Year 2020. The negative impacts stem from the lower effectiveness of the VMT and EE complementary policies, which are otherwise the ones most capable of generating cost savings. Without them at full strength, the economic impact is not surprisingly more negative than other cases.

6. Cap 5+CP-HighPrice (C&T with a 50 percent increase in all energy prices and 30 percent increase in construction costs: $5 allowance price). This case yields negative impacts on the economy on the order of a -0.42 percent decrease in GSP in the Year 2020 and a loss of 721 jobs. The negative outcome is due primarily to the condition of high energy prices in relation to baseline conditions.

7. Cap 20+CP-HighPrice (C&T with a 50 percent increase in all energy prices and 30 percent increase in construction costs: $20 allowance price). This case yields the most negative impacts of all the cases in terms of net present value of GSP impacts over the planning horizon. However, the income and employment impacts in the Year 2020 are not as low as in case 5. The GSP loss in 2020 is $567 million, or 0.3 percent of the projected baseline. The 2020 employment loss amounts to just slightly above 2,000 jobs, or a decrease of 0.17 percent of projected baseline.

Table ES2 presents the impacts of the seven policy cases on electricity prices, distinguishing residential from non-residential. In Cases 1, 2, 3 and 5 starting in 2012, and in Case 4 starting in 2015, we project a decrease in these prices. This result stems primarily from the negative shift in demand associated with energy efficiency and other types of conservation. The positive increases in electricity prices in Cases 6 and 7, and in early years of Case 4, stems from the existence of high energy prices in comparison to the baseline and a high allowance price.

Gasoline prices are projected to increase a mere 0.04 percent for each policy case in the Year 2012, increasing to between 0.14 and 0.18 percent in Year 2015, and 0.27 to 0.34 percent in Year 2020. Petroleum price increases are about 50 percent higher for each of these three years. The increases are highest in those cases where allowance prices are highest, energy prices are highest, or VMT and EE polices are not fully implemented.

Tax revenue impacts track qualitatively with GSP impacts in the Year 2020, i.e., they are positive for Cases 1 and 2, and negative for Cases 3-7. Generally the tax revenue impacts are lower than the GSP impacts in percentage terms, with the highest positive impact being 0.29 percent (Case 1), and the highest negative impact being 0.368 percent (Case 5).

There are only slight differences in New Mexico GHG emission reductions achieved across the seven simulated policy cases. The New Mexico total GHG emission reduction target in Year 2020 is 63.99 MMtCO2e in order to meet the proposed requirement that emissions be 10% below 2000 levels by Year 2020. This requires that NM reduce its emissions 7.61 MMtCO2e below projected baseline of 71.6 MMtCO2e in the Year 2020. In all the cases, New Mexico reduces emissions between 1.5 and 3.7 MMtCO2e through its own mitigation activities (or 19 percent to 48 percent of the total emission reduction target of 7.61 MMtCO2e), None of the scenarios has a sufficiently high allowance price to incentivize facilities to implement emission reduction options to meet the emission reduction requirement proposed by the Environment Department. Instead the more cost-effective way for NM sources to meet their compliance obligation is to purchase emission allowances from within the WCI. So, while the regional emission reduction target will be met, the state emission reduction target will not under the seven scenarios alone. It is to be expected in any cap-and-trade program that some jurisdictions will be net buyers and others will be net sellers of allowances. The geography of the emission reduction is not important because GHGs are global pollutants, i.e., mitigation is equally effective at any location. This is one of the main advantages of cap and trade vs. command and control because it promotes use of the lowest cost options in general, and with no need to be concerned about the geographic concentration of emissions ("hot spots") in the case of GHGs.

The results presented here are consistent with results found by the authors in other states (see, e.g., Rose and Wei, 2009, 2010a; Miller et al., 2010). However, the modeling approach used in this analysis provided more conservative input data and took into consideration C&T, leading to somewhat more conservative impacts than those found in such states as Florida, Pennsylvania and Michigan.

Table ES1. Aggregate Economic Impacts of WCI Policy Scenarios
(GSP and income figures in million 2008$)

Scenario	Gross State Product Impacts		Income Impacts		Employment Impacts (Year 2020 Only)	
	Level (2010-2020 NPV)[a]	Percent (2020)	Level (2010-2020 NPV)	Percent (2020)	Level	Percent
1. Complementary	$674	0.17%	$125	0.02%	2,579	0.22%
2. Cap 5+CP	$542	0.13%	$93	-0.01%	2,171	0.18%
3. Cap 20+CP	$169	-0.02%	-$149	-0.11%	744	0.06%
4. Cap 40+CP	-$295	-0.18%	-$444	-0.23%	-763	-0.06%
5. Cap 50+CP-Half	-$1,038	-0.38%	-$856	-0.36%	-3,109	-0.26%
6. Cap 5+CP-HP	-$855	-0.42%	-$368	-0.20%	-721	-0.06%
7. Cap 20+CP-HP	-$1,167	-0.56%	-$567	-0.30%	-2,047	-0.17%

[a] NPV is Net Present Value.

Table ES2. Electricity Price Impacts of WCI Policy Scenarios (without allowance cost effect)[a, b]

	Residential (% change for selected years)			Non-Residential (% change for selected years)		
Scenario	2012	2015	2020	2012	2015	2020
1. Complementary	-1.66%	-4.42%	-2.86%	-1.98%	-5.25%	-3.35%
2. Cap 5+CP	-1.66%	-4.42%	-2.86%	-1.97%	-5.24%	-3.34%
3. Cap 20+CP	-0.76%	-1.59%	-2.41%	-0.89%	-1.84%	-2.80%
4. Cap 40+CP	1.63%	-1.98%	-1.82%	1.98%	-2.31%	-2.10%
5. Cap 50+CP-Half	-0.41%	-0.41%	-0.70%	-0.48%	-0.44%	-0.78%
6. Cap 5+CP-HP	1.57%	4.63%	14.05%	1.91%	5.67%	17.30%
7. Cap 20+CP-HP	-0.27%	4.80%	14.07%	-0.30%	7.43%	17.32%

[a] All the price impacts are measured in real terms and all the percentages are changes from baseline level. .
[b] The production cost increases of the power sector due to the purchase of any allowances (or the allowance cost the power sector may pass through to its customers) are not included in the calculation in this table.

I. Introduction and Overview

This report evaluates the economic impacts of New Mexico's participation in the Western Climate Initiative (WCI) cap and trade program. The WCI is a collaboration of Western states and Canadian provinces working together to identify, evaluate, and implement policies to tackle climate change at a regional level. Through a combination of a regional cap-and-trade program and complementary policies, the WCI's goal is to reduce the pollution emissions that cause global warming to 15 percent below year 2005 levels by 2020.

These polices will have a major effect at the site of the implementation of individual mitigation and sequestration options. Some of these policy options can result in cost-savings directly to businesses who implement them, as well as providing gains to their customers if the savings are passed on in the form of lower prices. Such cost savings generate increased disposable income for households and greater competitive standing of businesses in the region. It is also likely that some emission reduction policy options will result in additional costs to businesses, households, non-profit institutions, and government operations.

Complicating the situation are various types of indirect effects stemming from the interdependence of segments of the economy. Indirect effects are exemplified by changes in demand for inputs along the supply chain that generate "multiplier effects," i.e., they are multiple of the direct effects.[2] Cost savings are passed along to several successive rounds of customers to add further to the economic stimulus. Decreases in demand will have their own multiplier effects on different sets of suppliers and customers in an analogous negative way (see, e.g., Rose and Oladosu, 2002; Rose and Wei, 2009, 2010a; Miller et al., 2010). Estimates of both direct effects and all associated ripple effects are required for estimating economy-wide impacts of policy changes.

The purpose of this report is to estimate the economy-wide impacts on New Mexico of implementing the WCI cap and trade program design. The assumptions for this modeling effort are consistent with those for the Energy 2020 Phase 3 work conducted by the WCI. Additional information about the WCI modeling effort may be found on the WCI website (http://www.westernclimateinitiative.org). In this study, we used the Regional Economic Models, Inc. (REMI) Policy Insight (PI+) Model (REMI, 2010), the most widely used state-level economic modeling software package in the U.S. The New Mexico version of the REMI Model was applied to the estimation of the macroeconomic impacts of the major GHG mitigation policies and the cap and trade (C&T) program on output, income, employment, and prices in the state for years 2010-2020. The application involves the most extensive analysis of the linkages between the C&T program as well as the complementary policies and the workings of the state economy to date.

Our results indicate that the net macroeconomic impacts on the New Mexico economy will be slightly positive if the allowances are freely granted or auctioned at a low price. While many mitigation activities incur costs, as when there is a need to purchase new equipment, these activities are more than offset by shifts in spending out of energy savings and by the stimulus to businesses in the state that produce the necessary equipment. If the allowances are auctioned at a relatively high price, the complementary policies cannot be fully implemented, or energy price and construction costs are significantly higher than in the base case, the overall impacts of the C&T program on the state economy will be slightly negative.

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[2] For example, final demand increase in one sector would lead to increases in this sector's purchases of raw materials. Then more raw material suppliers in turn purchase more of the inputs they need. Therefore, the original "direct" impact in one sector generates several successive rounds of input changes of its "upstream" suppliers. The total amount of these many rounds of "indirect" impacts is some multiple of the amount of the "direct" impact itself. Hence, this is often referred to as the "multiplier" effect throughout the entire economy.

This report is divided into 5 sections. Section 2 summarizes the choice of the REMI PI$^+$ model that we will use to estimate the macroeconomic impacts. Section 3 presents an overview of how we translate the results of the WCI ENERGY 2020 microeconomic analysis into REMI simulation policy variables, as well as how the data are further refined and linked to key structural and policy variables in the Model. Section 4 summarizes the set-up process of policy simulations in the REMI PI$^+$ model. Section 5 presents and interprets the simulation results. Section 6 provides a summary.

II. REMI Model Analysis

Several modeling approaches can be used to estimate the total regional economic impacts of environmental policy, including both direct (on-site) effects and various types of indirect (off-site) effects. These include: input-output (I-O), computable generated equilibrium (CGE), mathematical programming (MP), and macroeconometric (ME) models. Each has its own strengths and weaknesses (see, e.g., Rose and Miernyk, 1989; Partridge and Rickman, 1998).

The choice of which model to use depends on the purpose of the analysis and various considerations that can be considered as performance criteria, such as accuracy, transparency, manageability, and costs. After careful consideration of these criteria, we chose to use the Regional Economic Models, Inc. (REMI) Policy Insight Plus (PI$^+$) Model. The REMI PI$^+$ Model is superior to the others reviewed in terms of its forecasting ability and is comparable to CGE models in terms of analytical power and accuracy. With careful explanation of the model, its application, and its results, it can be made as transparent as any of the others.[3] Moreover, the research team has used the model successfully in similar analyses in the states of Florida, Pennsylvania, Michigan and Wisconsin (Rose and Wei, 2009; Rose and Wei, 2010a; Miller et al., 2010).

The REMI Model has evolved over the course of 30 years of refinement (see, e.g., Treyz, 1993). It is a packaged program but is built with a combination of national and region-specific data. Government agencies in practically every state in the U.S. have used a REMI Model for a variety of purposes, including evaluating the impacts of the change in tax rates, the exit or entry of major businesses in particular or economic programs in general, and, more recently, the impacts of energy and/or environmental policy actions.

A detailed discussion of the major features of the REMI Model is presented in appendix A. We simply provide a summary for general readers here. A macroeconometric forecasting model covers the entire economy, typically in a "top-down" manner, based on macroeconomic aggregate relationships such as consumption and investment. REMI differs somewhat in that it includes some key relationships, such as

[3] There is a debate about the size of the multipliers used in different regional policy analysis models. Rickman and Schwer (1995) compared the default multipliers in three of these models: IMPLAN, REMI and RIMS II. The comparison shows that the default multipliers have significant differences. Comparatively speaking, IMPLAN estimates the largest multipliers, while REMI estimates the smallest multipliers. The differences stem from three major causes. However, the REMI model has its special features that are important to our policy analysis. First, both IMPLAN and RIMS II are static input-output models, while the REMI model is dynamic. Thus, the REMI model has the capability to analyze the time path of impacts of the simulated policy change and is superior to the other two models in terms of its forecasting ability. In fact, the implicit multipliers of REMI vary from year to year. Second, the REMI model is non-linear. Therefore, in contrast to the other two models, the REMI simulation results are not dependent on fixed multipliers or linear relationship with the input data. In the REMI analysis, changes in the magnitude of the inputs will lead to an appropriate variation in the model's multipliers. Moreover, since the REMI multipliers are generally smaller than the multipliers of the other two models, this means that our impacts lean to the more conservative side, i.e., positive economic impacts are more likely to be understated than overstated.

exports, in a bottom-up approach. In fact, it makes use of the finely-grained sectoring detail of an I-O model, i.e., it divides the economy into 169 sectors, thereby allowing important differentials between them. This is especially important in a context of analyzing the impacts of GHG mitigation actions, where various options were fine-tuned to a given sector or where they directly affect several sectors somewhat differently.

The macroeconomic character of the model is able to analyze the interactions between sectors (ordinary multiplier effects) but with some refinement for price changes not found in I-O models. In other words, the REMI model incorporates the responses of the producers and consumers to price signals in the simulation. In contrast, in a basic input-output model, the change in prices is not readily taken into account. More specifically, a basic input-output model separates the determinants of quantity and prices, i.e., price changes will not generate any substitution effects in an I-O analysis, while the REMI model is capable to capture this and other price-quantity interactions.[4] The REMI Model also brings into play features of labor and capital markets, as well as trade with other states or countries, including changes in competitiveness.

The econometric feature of the model refers to two considerations. The first is that the model is based on inferential statistical estimation of key parameters based on pooled time series and regional (panel) data across all states of the U.S. (the other candidate models use "calibration," based on a single year's data).[5] This gives the REMI PI$^+$ model an additional capability of being better able to extrapolate the future course of the economy, a capability the other models lack. The major limitation of the REMI PI$^+$ model versus the others is that it is pre-packaged and not readily adjustable to any unique features of the case in point. The other models, because they are based on less data and a less formal estimation procedure, can more readily accommodate data changes in technology that might be inferred, for example from engineering data. However, our assessment of the REMI PI$^+$ Model is that these adjustments were not needed for the purpose at hand.

The use of the REMI PI$^+$ Model will involve the generation of a baseline forecast of the economy through 2020, consistent with the New Mexico Energy 2020 baseline (see Appendix B for a summary of how we reconcile the REMI model forecast with the economic and energy consumption forecast used in the Energy 2020 mode). Then simulations are run of the changes brought about through the implementation of the various GHG mitigation policy options. This includes the direct effects in the sectors in which the options are implemented, and then the combination of multiplier (purely quantitative interactions), general equilibrium (price-quantity interactions), and macroeconomic (aggregate interactions) impacts. The differences between the baseline and the "counter-factual" simulation represent the total state economic impacts of these policy options.

III. Input Data

The quantification analysis of the costs/savings of policy options in the WCI ENERGY 2020 analysis is limited to the direct effects of their implementation. For example, the direct costs of an energy efficiency

[4] The production cost change of each sector in REMI will first affect the price of the goods produced by this sector. Then the price change will generate successive impacts to the down-stream customer sectors that use the product of sector *i* as an intermediate input. The only exception is that REMI does not fully pass the production cost change of the energy supply sector (especially the electric generation sector) to the down-stream commercial and industrial customer sectors automatically. This must be done by manual insertions of changes in the model.

[5] REMI is the only one of the models reviewed that really addresses the fact that many impacts take time to materialize and that the size of impacts changes over time as prices and wages adjust. In short, it better incorporates the actual dynamics of the economy.

option include the energy customers' expenditure on energy efficiency equipments and devices. The direct benefits of this option include the savings on energy bills of the customers.

Before undertaking any economic simulations, the costs and savings of each policy options are translated to REMI Model inputs for generating economy-wide estimated impacts. This step involves the selection of appropriate policy levers in the REMI PI$^+$ Model to simulate the policy's changes. The input data include sectoral spending and savings over the full time horizon (2010-2020) of the analysis.

Major ENERGY 2020 outputs include the following:

- GHG emissions reductions by sector
- Electricity generation capacity and generation output by fuel type
- Electricity sales by sector
- Utility generating cost
- Fuel prices by sector
- Fuel expenditures by sector
- Device investment by sector
- Process investment by sector
- Distance travelled
- Vehicle efficiency

In this study we will perform analyses on two sets of GHG mitigation policy options: complementary policies (Energy Efficiency, Clean Car Standards, and VMT Reductions) and the policy options implemented under the cap and trade program.

Table 1 presents the mapping of ENERGY 2020 Model outputs into REMI inputs for an example policy.

The following ENERGY 2020 data, in real dollar values, are utilized as input data in REMI:

1. Annualized Device Investment
2. Annualized Process Investment
3. Operations and maintenance (O&M) Expenditures
4. Annual Fuel Expenditures
5. Generating Utility Costs (by generation type)

The original data we obtain from the ENERGY 2020 Model are the simulation outputs of the reference case run and the individual policy case runs. Since the REMI model simulations are driven by the *value changes* of the policy-related variables, or "policy levers," with respect to the baseline levels, we first compute the difference in values of the above key variables of the policy case runs from the reference case run of the ENERGY 2020 model.

The mapping in Table 1 is divided into five main sections, each of which section illustrates the bridge of one of the ENERGY 2020 data categories to REMI policy lever inputs. The first column shows the ENERGY 2020 output data categories as well as the ENERGY 2020 sectors. The second column shows the selection of policy levers in the REMI model. The third column includes notes on additional assumptions adopted in the calculation of the REMI input data.

The first set of inputs is the change in annualized device investment, which represents the capital investment in energy efficiency equipment and devices by the residential, commercial, and industrial sectors. For the non-transportation commercial and industrial sectors, the impacts of capital investment are simulated in REMI by increasing the value of the "Capital Cost" variable of individual commercial

Table 1. Mapping Table of ENERGY 2020 Direct Economic Impacts and REMI Policy Variables for an Example Policy Case

ENERGY 2020 Direct Economic Impact	REMI Policy-Related Variable	Notes and Additional Assumptions
1. Change in Annualized Device Investment of the following sectors: Residential Commercial Paper Chemicals Petroleum Nonmetallic Minerals Primary Metals Mining Except Oil and Gas Oil and Gas Extraction Other Industry Passenger Transportation Freight Transportation Agriculture Waste & Wastewater	<u>Non-Transportation Commercial and Industrial Sectors</u>: Investment Expenditure Impacts: Compensation, Prices, and Costs Block→Capital Cost (amount) for individual REMI non-transportation commercial and industrial sectors→Increase in most sectors Investment Impacts on Equipment Supply Sectors: Output and Demand Block→Investment Spending (amount)→Producers Durable Equipment→Increase Interest Payment of Financing: Output and Demand Block →Exogenous Final Demand (amount) for Monetary Authorities, Credit Intermediation sector→Increase <u>Transportation Sectors</u>: Freight Transportation: Investment Expenditure Impacts: Compensation, Prices, and Costs Block→Capital Cost (amount) for Truck Transportation sector and Rail Transportation sector→Decrease in early years and increase in later years Investment Impacts on Transportation Equipment Mfg sectors: Output and Demand Block→Exogenous Final Demand (amount) of the Motor Vehicle Mfg sector, Motor Vehicle Parts Mfg sector, and Railroad Rolling Stock Mfg sector→Decrease in early years and increase in later years Interest Payment of Financing: Output and Demand Block →Exogenous Final Demand (amount) for Monetary Authorities, Credit Intermediation sector→ Decrease in early years and increase in later years <u>Residential Sector</u>: *Energy Efficiency Appliances and Devices*: Investment Expenditure Impacts: Output and Demand Block→Consumer Spending (amount)→Kitchen & Other Household Appliances and Video & Audio Goods→Increase Investment Impacts on Equipment Supply Sectors: Through internal linkages of the Consumer Spending variable and Final Demand variable of affected manufacturing sectors. <u>Interest Payment of Financing: Output and Demand Block→Consumer Spending</u>	Changes in the value of Device Investment can be treated as capital investment to energy efficiency equipment. The REMI Model has a much more disaggregated sectoring scheme than the ENERGY 2020 model. We distribute the energy efficiency investment expenditures among relevant REMI commercial and industrial sectors using sectoral energy consumption as weights. For the Truck Transportation sector, we split the capital investment 9:1 between Motor Vehicle Mfg sector and Motor Vehicle Parts Mfg sector. We assume 50% of the capital investment will come from financing and the interest payment accounts for around 30% of the total financed capital investment.

	(amount)→ Bank Service Charges →Increase Consumption Reallocation among Goods: Output and Demand Block→Consumption Reallocation (amount)→All Consumption Categories→Decrease *Passenger Cars*: Investment Expenditure Impacts: Output and Demand Block→Consumer Spending (amount)→New Autos, Net Purchases of Used Autos, Other Motor Vehicles, and Motor Vehicle Parts→Decrease Investment Impacts on Vehicle and Vehicle Parts Suppliers: Through internal linkages of the Consumer Spending variable and Final Demand variable of affected manufacturing sectors. Interest Payment of Financing: Output and Demand Block→Consumer Spending (amount)→ Bank Service Charges →Decrease Consumption Reallocation among Goods: Output and Demand Block→Consumption Reallocation (amount)→All Consumption Categories→Increase	
2. Change in Annualized Process Investment of the following sectors: Residential Commercial Paper Chemicals Petroleum Nonmetallic Minerals Primary Metals Mining Except Oil and Gas Oil and Gas Extraction Other Industry Passenger Transportation Freight Transportation Agriculture Waste & Wastewater	<u>Non-Transportation Commercial and Industrial Sectors</u>: Investment Expenditure Impacts: Compensation, Prices, and Costs Block→Capital Cost (amount) for individual REMI non-transportation commercial and industrial sectors→Increase in most sectors Investment Impacts on Building Materials Supply Sectors: Output and Demand Block→Exogenous Final Demand (amount) of Construction sector, Glass and Glass Product Mfg sector, Plastics Product Mfg sector, Other Non-Metallic Mineral Product Mfg sector, Veneer, Plywood, and Engineered Wood Product Mfg sector, Clay Product and Refractory Mfg sector→Increase Interest Payment of Financing: Output and Demand Block →Exogenous Final Demand (amount) for Monetary Authorities, Credit Intermediation sector→Increase <u>Residential Sector</u>: Investment Expenditure Impacts: Output and Demand Block→Consumer Spending (amount)→Other Durable House Furnishings→Increase Investment Impacts on Equipment Supply Sectors: Through internal linkages of the Consumer Spending variable and Final Demand variable of affected manufacturing sectors.	Process investment is investment to improve building efficiency. Again, we use the sectoral energy consumption as weights to distribute the investment cost across relevant REMI commercial and industrial sectors. For the Industrial sectors, we assume that 50% of the investment goes to the Construction sector, 20% to Glass and Glass Product Mfg sector, 10% to Plastics Product Mfg sector, 10% to Other Non-Metallic Mineral Product Mfg sector, and 10% to Clay Product and Refractory Mfg sector. For the Commercial sectors, we assume that 40% of the investment

	Interest Payment of Financing: Output and Demand Block→Consumer Spending (amount)→ Bank Service Charges →Increase Consumption Reallocation among Goods: Output and Demand Block→Consumption Reallocation (amount)→All Consumption Categories→Decrease	goes to the Construction sector, 20% to Glass and Glass Product Mfg sector, 10% to Plastics Product Mfg sector, 10% to Other Non-Metallic Mineral Product Mfg sector, 10% to Veneer, Plywood, and Engineered Wood Product Mfg sector, and 10% to Clay Product and Refractory Mfg sector.
3. Change in O&M Expenditures of the following sectors: Residential Commercial Paper Chemicals Petroleum Nonmetallic Minerals Primary Metals Mining Except Oil and Gas Oil and Gas Extraction Other Industry Passenger Transportation Freight Transportation Agriculture Waste & Wastewater	<u>Commercial and Industrial Sectors</u>: Cost Impacts: Compensation, Prices, and Costs Block→Production Cost (amount) for individual commercial and industrial sectors→Increase Stimulus/Dampening Impacts: Output and Demand Block→Industry Sales (amount) for each relevant commercial and industrial sector (assume the O&M activities are performed by the same sector that increases the O&M expenditure) →Increase in most sectors <u>Residential Sector</u>: *O&M of Energy Efficiency Appliances and Devices*: Cost Impacts: Output and Demand Block→Consumer Spending (amount)→Other Household Operation→Increase Stimulus Impacts: Through internal linkages of the Consumer Spending variable and Final Demand variable of affected O&M services providing sectors. Consumption Reallocation: Output and Demand Block→Consumer Reallocation (amount)→All Consumption Categories→Decrease *O&M of Passenger Vehicles*: Cost Impacts: Output and Demand Block→Consumer Spending (amount)→Motor Vehicle Repair, Rental, Leasing→Decrease in early years and increase in later years Stimulus Impacts: Through internal linkages of the Consumer Spending variable and Final Demand variable of affected O&M services providing sectors. Consumption Reallocation: Output and Demand Block→Consumer Reallocation (amount)→All Consumption Categories→ Increase in early years and decrease in later years	Again, we use sectoral energy consumption as weights to distribute the O&M cost across relevant REMI commercial and industrial sectors.
4. Change in Fuel Expenditures of the following	<u>Non-Transportation Commercial and Industrial Sectors</u>: Cost Impacts: Compensation, Prices, and Costs Block→Electricity Fuel Cost (share) and	Under the policy runs, the fuel expenditures (in dollar value terms) are

sectors: Residential Commercial Paper Chemicals Petroleum Nonmetallic Minerals Primary Metals Mining Except Oil and Gas Oil and Gas Extraction Other Industry Passenger Transportation Freight Transportation Agriculture Waste & Wastewater	NG Fuel Cost (share) for individual REMI non-transportation commercial and industrial sectors→Increase Stimulus/Dampening Impacts to energy supply sectors: Output and Demand Block→Exogenous Final Demand (amount) of Electric Power Generation, Oil and Gas Extraction, Coal Mining, and Petroleum and Coal Products Manufacturing sectors→Decrease <u>Transportation Sectors</u>: Freight Transportation: Cost Impacts: Compensation, Prices, and Costs Block→ Residual Fuel Cost (amount) for the Truck Transportation sector→Decrease Stimulus/Dampening impacts to energy supply sectors: Output and Demand Block→Exogenous Final Demand (amount) of the Petroleum and Coal Products Manufacturing sector→Decrease <u>Residential Sector</u>: *Electricity and NG*: Output and Demand Block→Exogenous Final Demand (amount) of Electric Power Generation and Oil and Gas Extraction sectors→Decrease Consumption Reallocation: Output and Demand Block→Consumer Reallocation (amount)→All Consumption Categories→Increase *Gasoline*: Output and Demand Block→Exogenous Final Demand (amount) of Petroleum and Coal Products Manufacturing sector→Decrease Consumption Reallocation: Output and Demand Block→Consumer Reallocation (amount)→All Consumption Categories→Increase	estimated to go up for the non-transportation commercial sector, industrial sector, and residential sector. This is mainly because of the increased energy prices stemming from the high allowance price. However, energy use in quantity terms goes down. In the calculation, we use the fuel prices that exclude the effect of permits cost to compute the final demand change to the energy supply sectors. The (excluding permits) prices are obtained from the Complementary Policies Run.
5. Generating Utility Costs: Annualized Investments Fuel Expenditures O&M	Annualized Investments: Investment Expenditure Impacts to the Power sector: Compensation, Prices, and Costs Block →Capital Cost (amount) of Electric Power Generation sector→Decrease Investment Impacts on Construction and Equipment Mfg sectors: Output and Demand Block→Exogenous Final Demand (amount) of Construction sector and Engine, Turbine, Power Transmission Equipment Mfg sector→Decrease O&M:	Capital investment in power generation is split 60:40 between sectors that provide generating equipment and the construction sector for large power plants (such as coal-fired power plants), and 80:20 for smaller installations (mainly renewables).

	Cost Impacts to the Power sector: Compensation, Prices, and Costs Block →Production Cost (amount) of Electric Power Generation sector→Decrease Stimulus/Dampening Impacts: Output and Demand Block→Industry Sales (amount) of Electric Power Generation sector (assume the O&M activities are performed by the Power Generation sector) →Decrease Fuel Expenditures: Cost Impacts to the Power sector: Compensation, Prices, and Costs Block →Production Cost (amount) of Electric Power Generation sector→Decrease Stimulus/Dampening Impacts: Output and Demand Block→Final Demand (amount) of Coal Mining sector and Oil and Gas Extraction sector, Proprietors' Income of the Farm sector, and Industry Sales of Ag and Forestry sector →Decrease	

sectors and individual industrial sectors. We assume that 50% of the capital investment will come from financing and the interest payment accounts for around 30% of the total financed capital investment. The investment impacts on equipment supply sectors are simulated by increasing the value of the "Investment Spending on Producers Durable Equipment" variable in REMI. For the capital investment change in freight transportation, we change the value of the "Capital Cost" variable of the Truck Transportation sector and Rail Transportation sector. The corresponding investment impacts are the "Exogenous Final Demand" changes to the Motor Vehicle Manufacturing, Motor Vehicle Parts Manufacturing, and Railroad Rolling Stock Manufacturing sectors. Since the REMI model has a much more disaggregated sectoring scheme than the ENERGY 2020 Model, we distribute the total capital cost among the relevant REMI commercial and industrial sector, and between Truck Transportation and Rail Transportation sectors using sectoral energy consumption as weights. For example, the ENERGY 2020 Model only provides the data for the aggregated commercial sector. The total capital investment cost is distributed among the 61 non-transportation commercial REMI sectors based on the sectoral fuel consumptions. The interest payment of financed capital investment is simulated as "Exogenous Final Demand" change to the Monetary Authorities, Credit Intermediation sector. For the residential sector, the capital investment change to energy efficiency appliances and devices and the investment change to passenger cars are simulated separately. For the former, the investment expenditure changes are simulated as "Consumer Spending" change in Kitchen & Other Household Appliances and Video & Audio Goods. For the latter, we change the "Consumer Spending" in New Autos, Net Purchases of Used Autos, Other Motor Vehicles, and Motor Vehicle Parts. The baseline Personal Consumption Expenditure (PCE) weights are used to divide the spending among the various relevant consumption categories. Household interest payments from financing purchases are simulated as a change in the "Consumer Spending" in Bank services. Personal consumption on all the other goods and services is changed correspondingly. For example, if households increase their spending in efficiency appliances, we assume that the households will decrease their spending proportionally on all the other goods and services. In the REMI Model, the investment impacts on the appliances and equipment supply sectors and the vehicle and vehicle parts manufacturing sectors are forthcoming through internal linkages of the "Consumer Spending" variable and the "Exogenous Final Demand" variable of the affected manufacturing sectors. The "Capital Cost" variable is in the "Compensation, Prices, and Costs Block" of the REMI model, while the "Exogenous Final Demand", "Investment Spending on Producers Durable Equipment", "Consumer Spending (amount)" and "Consumption Reallocation (amount)" variables can be found in the "Output and Demand Block" in the REMI Model.[6]

The second set of inputs is the change in annualized process investment. In the ENERGY 2020 model, process investment represents the investment to improve building efficiency by the residential, commercial, and industrial sectors. For the commercial and industrial sectors, this is again simulated as "Capital Cost" increase of individual commercial sectors and individual industrial sectors, using the sectoral energy consumption as weight for the cost distribution. The corresponding stimulus investment impacts are simulated by increasing the "Exogenous Final Demand" of the Construction sector and the following building materials manufacturing sectors: Glass and Glass Product Manufacturing sector, Plastics Product Manufacturing sector, Other Non-Metallic Mineral Product Manufacturing sector, Veneer, Plywood, and Engineered Wood Product Manufacturing sector, Clay Product and Refractory Manufacturing sector. For the commercial sectors, we assume the split percentages among these sectors are 40%, 20%, 10%, 10%, 10%, and 10%, respectively. For industrial sectors, the assumed split percentages among these sectors are 50%, 20%, 10%, 10%, 0%, and 10%, respectively. For the residential sector, the investment expenditure on building materials are simulated as increased "Consumer Spending" in Other Durable House Furnishings (and decreasing all the other consumptions

[6] The overall structure of the REMI Model can be summarized in five major blocks: (1) Output and Demand, (2) Labor and Capital Demand, (3) Population and Labor Supply, (4) Compensation, Prices, and Costs, and (5) Market Shares. The blocks and their key interactions are shown in two Figures in Appendix A.

correspondingly). As for the interest payment of financing, we again change the "Exogenous Final Demand" of the Monetary Authorities, Credit Intermediation sector for the commercial and industrial sectors and change the "Consumer Spending" in Bank services for the residential sector.

The third set of input data is the change in O&M expenditures. For commercial and industrial sectors, this is simulated by increasing the value of the "Production Cost" variable of individual commercial sectors and individual industrial sectors. The corresponding stimulus or dampening impacts (for the increased or decreased O&M expenditures) are simulated by increasing the value of "Industry Sales" for each relevant sector (assuming the O&M activities are performed by the same sector that increases the O&M expenditure).[7] The "Production Cost" variable is in the "Compensation, Prices, and Costs Block" of the REMI model, while the "Industry Sales" variable can be found in the "Output and Demand Block". For the residential sector, the O&M expenditures on energy efficiency appliances and devices and on passenger vehicles are simulated by increasing the "Consumer Spending" in Other Household Operation and in Motor Vehicle Repair, respectively. The consumer expenditures on all the other commodity categories are adjusted accordingly.

The fourth set of inputs is the change in fuel expenditures. In many policy runs that combine the cap and trade program with the complementary policies, fuel expenditures (in dollar value terms) are estimated to rise for the non-transportation commercial sector, industrial sector, and residential sector. This is mainly because of the increased energy prices stemming from the need to purchase allowances. The energy use in quantity terms actually declines in the policy runs. For the non-transportation commercial, industrial, and residential sectors, the increased fuel expenditures are simulated by increasing the "Electricity and Natural Gas Fuel Cost" variables. The "Exogenous Final Demand" of the Electric Power Generation, Oil and Gas Extraction, Coal Mining, and Petroleum and Coal Products Manufacturing sectors is decreased to reflect the fact of reduced fossil fuel consumptions in quantity terms. For the transportation sector, due to the policies of Clean Car Standards and VMT reductions, the transportation fuel consumption is estimated to decline. This is simulated by decreasing the value of the "Residual Fuel Cost" variable of the Truck Transportation sector.[8] The "Exogenous Final Demand" of the Petroleum and Coal Products Mfg sector is decreased at the same time. For the residential sector, as the consumptions in fuel commodities change, the consumption expenditures on all the other commodity categories are adjusted accordingly. As with the "Capital Cost" and "Production Cost" variables, the "Fuel Cost" variables can be found in the "Compensation, Prices, and Costs Block" of the REMI model.

The last set of input data is for the Electric Power Generation sector. The changes in utility generating costs for each generation type are divided into three components: annualized capital investment, fuel expenditures, and O&M expenditures. According to the ENERGY 2020 Model, reductions in the demand of electricity due to energy efficiency improvement in the end-use sectors will decrease electricity generation output over the program period (for both conventional fossil fuel and renewable electricity generation). The decreased capital investment is simulated as a "Capital Cost" decrease in the Electric Power Generation sector, while the decrease in O&M and fuel expenditures are simulated by reducing the

[7] When the production cost of the industrial and commercial sectors are increased due to the increased O&M expenditures, REMI does not automatically increase the value of industry sales to reflect the increased value of O&M. Therefore, when it is assumed that the O&M activities are preformed by the same sector that makes the O&M payments, the value of the "Production Cost" variable and the value of the "Industry Sales" variable of the same sector need to be increased in two separate steps in REMI.

[8] The REMI Model only provides limited variable choices to simulate the changes in fuel expenditures by sector. The alternative fuel cost variables in the model include Electricity Fuel Cost, NG Fuel Cost, and Residual Fuel Cost variables. In this study, we use the "Residual Fuel Cost" variable to simulate the fuel expenditure changes in the freight transportation sector. Another possible approach is to use the "Production Cost" variable instead. However, there will be only slight difference in the aggregate economic impacts between the uses of these two alternative policy levers.

value of the "Production Cost" of the Power Generation sector. The corresponding dampening effects are the "Exogenous Final Demand" decrease of the Construction sector and Engine, Turbine & Power Transmission Equipment sector due to the reduced capital investment in the power sector, and the "Exogenous Final Demand" decrease of the Coal Mining sector and Oil and Gas Extraction sector and the "Industry Sales" decrease of the Ag and Forestry sector due to the reduced demand of fossil fuel inputs or biomass feedstock in power generation.

Double counting indirect effects can occur with the REMI simulation. Since the ENERGY 2020 model assumes 100 percent auction of the allowances, the data on fuel expenditure changes (in dollar terms) for the residential, commercial, and industrial sectors include the effect of allowances cost. In other words, when we use the ENERGY 2020 outputs data as inputs to the REMI Model, the fuel expenditure data already incorporate the higher utility cost stemming from the purchases of emission allowances from auction. To avoid potentially double counting of the Electric Power Generation sector impacts, we only simulate in REMI the impacts of changes in capital cost, O&M cost, and fuel cost of electricity generation. The production cost increase due to the purchases of allowances is not simulated in REMI for the Electric Power Generation sector. This is because the ENERGY 2020 model runs have already assumed that all the effects of the allowance cost will pass through to the consumer sectors through electricity and fuel price increases. If we simulate production cost increase for the power sector to reflect the allowance purchases at the same time, we will surely double-count the effect of the price increase.

In addition, changes in utility investment and utility fuel expenditures are also reflected in the price of electricity. Therefore, both the capital cost and fuel cost changes of the utility sector stemming from power generation mix and capacity changes are all reflected in the other sectors' use of electricity. Thus, including both utility investment and fuel expenditure changes along with the fuel expenditure changes of all other economic sectors simultaneously in the REMI simulation would result in some double-counting. To avoid the double-counting, we need to block the utility cost change passing onto the customer sectors through electricity price changes. Our previous experiences of REMI analysis indicate that the model automatically passes through the utility cost change onto electricity price change for the residential sector, but not to the producing sectors (commercial and industrial sectors). This is because the model treats all the fuel-producing industries differently than other producing sectors in a way that the capital and production cost changes in these sectors will not automatically pass through to the fuel buying sectors. Fuel is treated as a component of value-added in REMI, and thus it must be changed exogenously by the user. Therefore, in our case, we only need to block the utility cost pass through onto the residential sector. This is done by first running the value changes of utility generating costs in REMI. Then in the REMI output, we extract the results of residential electricity price changes in percentage terms. Next, in the second round simulation, we include all the policy variables again as in the first round simulation. However, we include one additional policy variable of residential electricity price change, with the value equal to residential electricity price change we get from the first round simulation but with a sign change, i.e., if the utility generating cost change yields a residential electricity price increase of 3% in the first round simulation, we reduce the residential electricity price by 3% in the second round simulation.

IV. Simulation Set-up in REMI

Figure 1 shows how a policy simulation process is undertaken in the REMI PI$^+$ model. First, a policy question is formulated (such as what would be the economic impacts of implementing the Energy Efficiency Programs). Second, external policy variables that would embody the effects of the policy are identified (e.g., for Energy Efficiency, relevant policy variables include incremental costs and investment

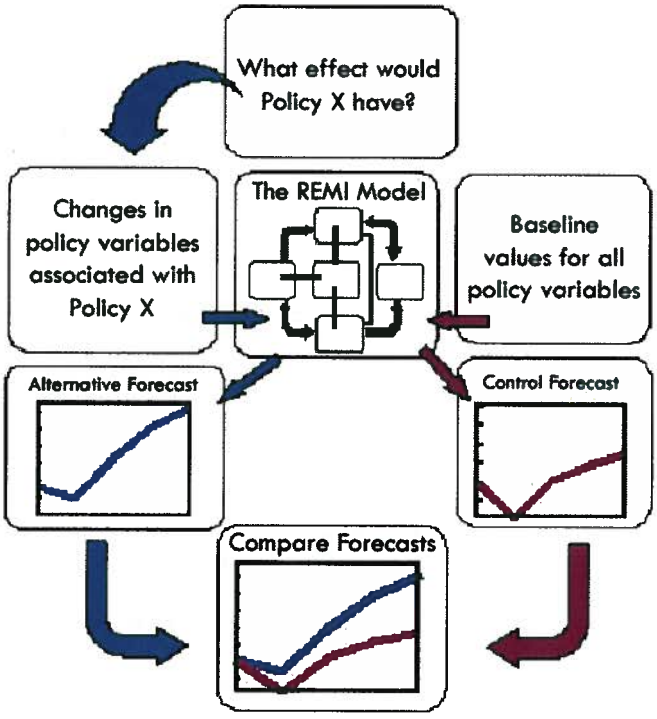

Figure 1. Process of Policy Simulation in REMI

in energy efficient appliances; final demand increase in the sectors that produce the equipments and appliances; and the avoided consumption of electricity, natural gas, etc.). Third, baseline values for all the policy variables are used to generate the control forecast (baseline forecast). In REMI PI$^+$, the baseline forecast uses the most recent data available (i.e., 2007 data) for the study region and the external policy variables are set equal to their baseline values. Fourth, an alternative forecast is generated by changing the values of the external policy variables. Usually, the changing values of these variables represent the direct effects of the simulated policy scenario. Fifth, the effects of the policy scenario are measured by comparing the baseline forecast and the alternative forecast. Sensitivity analysis can be undertaken by running a series of alternative forecasts or policy cases with different assumptions on the values of the policy variables.

In this study, we first run the REMI PI$^+$ model for each of the WCI policy options *individually* in a comparative static manner, i.e., one at a time, holding everything else constant. Next, we run a *simultaneous* simulation in which we assume that all the policies are implemented together. Then the simple summation of the effects of individual options is compared to the simultaneous simulation results to determine whether the "whole" is different from the "sum" of the parts. Differences can arise from non-linearities and/or synergies. The latter would stem from complex functional relationships in the REMI PI$^+$ Model.

V. Presentation of the Results

Preliminary results of the application of the REMI PI+ Model to the analysis of the impacts to the WCI Policy Case on the New Mexico economy are presented in this section. We began by examining seven policy cases consistent with the simulations performed by ICF. The cases varied according to

effectiveness of complementary policies, background considerations, and assumptions about emissions allowance prices. The seven cases are:

1. Aggregate Complementary Policies case: Complementary policies are often adopted in conjunction with the Cap-and-Trade (C&T) program. These policies are identified to promote emission reductions that are not responsive to price signals. In the WCI program, three complementary policies are included in the analysis. They are Clean Car Standards, Energy Efficiency, and Vehicle Miles Traveled (please see ICF (2010) for the details on the timing and target of these three complementary policies). In this policy case, we evaluate the macroeconomic impacts of a combination of these three complementary policies in NM alone. This means we exclude any policies that may come under the C&T program in this policy case analysis. In addition, this case assumes that all of the three complementary policies will be implemented at full effectiveness. Variation in the assumptions about the effectiveness of these policies will be addressed in Case 5 below.

2. Cap 5+CP case (C&T plus complementary policies: $5 allowance price):[9] Cases 2 to 4 correspond to the Main Policy Case in the WCI analysis. The Cap 5+CP case evaluates the impacts of the WCI C&T program in conjunction with the three complementary policies on the NM economy. The primary set of Economic Modeling Team (EMT) assumptions on future socio-economic conditions is adopted in this case. In this case, the ENERGY 2020 model assumes that the allowance price in Year 2020 is $5/ton, which is the lowest allowance price ICF analyzed for the Main Policy Case. As a result this is the policy case that is the closest approximation to the free-granting case.

3. Cap 20+CP case (C&T plus complementary policies: $20 allowance price): In the WCI analysis, the equilibrium allowance price of the Main Policy Case is $33/ton. Therefore, we analyzed $20/ton and $40/ton allowance price scenarios as sensitivity bounds for the Main Policy Case in this case and the following one. The $20/ton price is the lower bound for the allowance price.

4. Cap 40+CP case (C&T plus complementary policies: $40 allowance price): This is the upper-bound sensitivity case for the $33/ton allowance price of the Main Policy Case.

5. Cap 50+CP-Half case (C&T with VMT and EE cut in Half: $50 allowance price): This is the sensitivity case on the effectiveness of the complementary policies. This case assumes that only half of the emission reduction target of energy efficiency and VMT can be achieved. It assumes that the third complementary policy, Clean Car Standards, can still achieve its full emission reductions. The WCI analysis indicates an allowance price of at least $50/ton for mitigation compliance of the whole region in this case. Therefore, we analyzed the $50/ton allowance price scenario for this policy case.

6. Cap 5+CP-HighPrice case (C&T with 50% Increase in Energy Prices and 30% Higher Construction Costs: $5 allowance price): This and the following case assume that energy prices will increase in real terms by 50% by 2020 compared with the 2008 prices. The capital cost and the O&M cost for power generation are assumed to be 30% higher than in the Main Policy Case. Both of these price assumptions are intended to provide reasonable upper bounds for key prices in the estimates. In the WCI analysis, the equilibrium allowance price of the High Price Case is $13/ton. Therefore, the $5/ton scenario represents our lower-bound sensitivity case for the allowance price.

7. Cap 5+CP-HighPrice case (C&T with 50% Increase in Energy Prices and 30% Higher Construction Costs: $20 allowance price): The $20/ton scenario represents our upper-bound sensitivity case for the allowance price of the High Price Policy Case.

[9] Cases 2 through 7 are abbreviated as "Cap4" cases in the ENERGY 2020 simulations.

In the pages to follow, we present the impacts of each policy case on macroeconomic indicators of gross state product (GSP), income, and employment, as well as the impacts on energy prices. The results are presented for key years of planning horizon and for each of the 169 economic sectors. Also, net present value measures are presented for GSP and income outcomes. Note, however, that the employment impacts cannot be summed over the time horizon, because employment impact estimates for a given year are already cumulative up to a given date, i.e., the employment change in Year 2016 continues in 2017 plus any addition or deletion of jobs between the two years.

The results indicate that most of the scenarios (Cases 3-7) would have a very small negative impact on the state's economy by Year 2020, though two of the cases (Cases 1 and 2) yield slightly positive impacts. However, these positive outcomes are the most likely outcomes. This is because the ENERGY 2020 model assumes that 100% of the allowances will be auctioned and the allowance costs will be automatically passed through onto the energy consumers. However, NM proposes to allocate all the allowances freely, so there will be no additional cost pressures.[10] Therefore, the lowest allowance price scenario of the Main Policy Case best resembles the likely policy case in NM.

Table 2 presents the aggregate economic impacts of the seven policy cases. The following is a brief summary of each case:

1. Aggregated complementary policies. This case has the strongest positive impact on the New Mexico economy. We project an increase of $674 million dollars in net present value (time-discounted) terms over the planning horizon 2010-2020. The impacts are positive in the Year 2020 itself. The increase in gross state product (GSP) of 0.17 percent of economic activity translates into an increase of $150 million in GSP. Employment gains in the Year 2020 are over 2.5 thousand jobs in terms of person-year equivalents, or a 0.22 percent increase over baseline. The positive impacts stem primarily from cost savings associated with energy efficiency and reduced costs of transportation.

2. Cap 5+CP (C&T plus complimentary policies: $5 allowance price): This case yields positive impacts have the size of Case 1. It differs from case 1 only in that it adds a cap and trade feature, though has only a minimal dampening influence because the allowance price is so low. Like case 1, the impacts are mostly expected to be positive, though income impacts are mostly muted.

3. Cap 20+CP (C&T plus complimentary policies: $20 allowance price). This case also yields a positive impact, though it is extremely small over the entire planning horizon. The employment increase is only 0.06 percent, and in fact the GSP impact turns slightly negative by Year 2020. The impacts of this case are not as attractive as the previous one because of the higher allowance price.

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[10] The literature on emission allowance trading has traditionally postulated that there is no difference in outcomes with respect to economic efficiency between a system of free-granted allowances and a system of auctioned allowances. The former requires out-of-pocket expenditures, while *opportunity costs* of use of free-granted allowances are cited as a justification for an increase in cost to firms receiving them. That is, each time a firm uses an allowance, it foregoes the opportunity to reap revenues from its sale. While the conceptual grounding for this proposition is solid, real world policy-making is not likely to uphold it. Most analysts have recently concluded that public utilities commissions are unlikely to grant rate increases to electric utilities on the basis of free-granted permits (see, e.g., Burtraw et al, 2008). In fact, the recent Economic and Allocation Advisory Committee (EAAC) to the California Air Resources Board on the implementation of its climate action plan (Assembly Bill 32), recommended against any such rate increase on this basis. Even non-regulated firms in today's business environment are not likely to raise their prices because of the increase in opportunity costs so as to avoid adverse public reactions. Therefore, in this report, we assume direct and indirect cost impacts of free-granted versus auctioned allowances differ.

Table 2. Aggregate Economic Impacts of WCI Policy Scenarios
(GSP and income figures in million 2008$)

Scenario	GSP Impacts		Income Impacts		Employment Impacts (Year 2020 Only)	
	Level (2010-20 NPV)	Percent (2020)	Level (2010-20 NPV)	Percent (2020)	Level	Percent
1. Complementary	$674	0.17%	$125	0.02%	2,579	0.22%
2. Cap 5+CP	$542	0.13%	$93	-0.01%	2,171	0.18%
3. Cap 20+CP	$169	-0.02%	-$149	-0.11%	744	0.06%
4. Cap 40+CP	-$295	-0.18%	-$444	-0.23%	-763	-0.06%
5. Cap 50+CP-Half	-$1,038	-0.38%	-$856	-0.36%	-3,109	-0.26%
6. Cap 5+CP-HP	-$855	-0.42%	-$368	-0.20%	-721	-0.06%
7. Cap 20+CP-HP	-$1,167	-0.56%	-$567	-0.30%	-2,047	-0.17%

4. Cap 40+CP (C&T plus complimentary policies: $40 allowance price). This case yields uniformly negative impacts on the New Mexico economy, though they are still rather small. The GSP impact in the Year 2020 is -0.18 percent, and the employment loss in that year is -0.06 percent.

5. Cap 50+CP-Half (C&T with VMT and EE policies at half the previous levels: $50 allowance price). In this case, the negative impacts grow significantly. The GSP decrease is 0.38 percent in the Year 2020 and the employment decrease is -0.26 percent, or slightly more than 3,000 jobs. In terms of employment, this is the worst case scenario. This case also yields the most negative GSP impacts in the Year 2020. The negative impacts stem from the lower effectiveness of the VMT and EE complementary policies, which are otherwise the ones most capable of generating some cost savings. Without them at full strength, the economic impact is not surprisingly more negative than other cases.

6. Cap 5+CP-HighPrice (C&T with a 50 percent increase in all energy prices and 30 percent increase in construction costs: $5 allowance price). This case yields negative impacts on the economy on the order of a -0.42 percent decrease in GSP in the Year 2020 and a loss of 721 jobs. The negative outcome is due primarily to the condition of high energy prices in relation to baseline conditions.

7. Cap 20+CP-HighPrice (C&T with a 50 percent increase in all energy prices and 30 percent increase in construction costs: $20 allowance price). This case yields the most negative impacts of all the cases in terms of net present value of GSP impacts over the planning horizon. However, the income and employment impacts in the Year 2020 are not as low as in case 5. The GSP loss in 2020 is $567 million, or 0.3 percent of the projected baseline. The 2020 employment loss amounts to just slightly above 2,000 jobs, or a decrease of 0.17 percent of projected baseline.

The analyses above assume that allowances are auctioned. The out of pocket expenditures to purchase allowances will increase the emitters' cost of production, and they will attempt to pass on these cost increases in the form of higher prices to their customers. This, in turn increases the cost of production in other businesses, and continues through successive rounds of ripples of cost-push inflation. Moreover, it decreases the purchasing power of household income. All of this comes together to yield more negative impacts than in a case of free-granting of allowances.

The situation in New Mexico is different from the general WCI case. In New Mexico, the current policy proposal is not to auction allowances but to freely grant them. Thus, there should be no price pressures from the cap and trade aspect. However, ICF International, Inc. using their ENERGY 2020 Model did not simulate this case. We can, however, interpolate it as falling somewhere between the Complementary Policies case (which contains no allowance trading) and the Cap 5+CP case (Cases 1 and 2 in Table 2). Both of these yield positive impacts on the New Mexico economy in all respects. Therefore, our best estimate of the impacts of the proposed implementation of the Western Climate Initiative Policy Case on the New Mexico is a slightly positive impact on the order of approximately one-tenth of one percent (0.001) on major economic indicators over the course of the planning horizon and in the terminal Year 2020. Again, this positive economy-wide outcome stems primarily from cost-saving mitigation options associated with the proposed policy cases, from which savings are generated from energy efficiency gains and more sustainable transportation/land use policies. Additional positive economy-wide impacts arise from the inherent attractiveness of local renewable electricity generation and research that will decrease the cost of green generation with experience and improvements in economies of scale, while the prices of non-renewable fossil fuels in the baseline steadily increase.

Table 3 presents the impacts of the seven cases on electricity prices, distinguishing residential and other. In Cases 1, 2, 3 and 5 starting in 2012, and in Case 4 starting in 2015, we actually project a decrease in these prices. This result stems primarily from the negative shift in demand associated with energy efficiency and other types of conservation.[11] The positive increases in electricity prices in Cases 6 and 7, and in early years of Case 4, stems from the existence of high energy prices in comparison to the baseline and a high allowance price.

Table 4 presents the impacts of the 7 cases on gasoline prices for the residential sector and the delivered price of the Petroleum Products sector. Gasoline prices are projected to increase a mere 0.04 percent for each policy case in the Year 2012, increasing to between 0.14 and 0.18 percent in Year 2015, and 0.27 to 0.34 percent in Year 2020. Petroleum price increases are about 50 percent higher for each of these three years. The increases are highest in those cases where allowance prices are highest, energy prices are highest, or VMT and EE polices are not fully implemented.

Tax revenue impacts of the seven mitigation policy cases are presented in Table 5. The State Tax Revenues variable in REMI is the sum of Intergovernmental Revenue, General Sales Tax, License Taxes, Individual Income Tax, Corporate Income Tax, Other Taxes, Current Charges, Miscellaneous General Revenue, Utility Revenue, and Misc. Revenue. They do not include any allowance auction revenue, but this is actually a plus here, because the NM policy does not call for any to be generated. The impacts are trivial in the Year 2012, but take on some significance by the Year 2015. They follow the general trends of the macro impacts on GSP (see Appendix C), i.e., they are positive when GSP impacts are positive and negative when impacts are negative). For the Year 2020, this comparison is more evident (see also Table 2), where the two series track perfectly in a qualitative way, i.e., only Cases 3-7 are negatively impacted in terms of both GSP and tax revenues.

Tables 6 and 7 present the results in relation to major sectors positively and negatively affected by the proposed policy, in absolute and percentage terms, respectively. The results are reasonable with decreases in sectors such as electricity, coal mining, and petroleum refining, and increases in sectors that

[11] The impacts on the electricity price presented in this table are the effects of a negative shift in demand associated with energy efficiency. The total capital cost and production cost of the power sector decrease due to the demand decrease in cases 1 through 5. In cases 6 and 7, because of the high energy price and high generation cost assumptions, the total capital and production costs of the power sector increase despite the decrease in electricity demand, which lead to increases in electricity price.

Table 3. Electricity Price Impacts of WCI Policy Scenarios (without allowance cost effect)[a, b]

	Residential (% change for selected years)			Non-Residential (% change for selected years)		
Scenario	2012	2015	2020	2012	2015	2020
1. Complementary	-1.66%	-4.42%	-2.86%	-1.98%	-5.25%	-3.35%
2. Cap 5+CP	-1.66%	-4.42%	-2.86%	-1.97%	-5.24%	-3.34%
3. Cap 20+CP	-0.76%	-1.59%	-2.41%	-0.89%	-1.84%	-2.80%
4. Cap 40+CP	1.63%	-1.98%	-1.82%	1.98%	-2.31%	-2.10%
5. Cap 50+CP-Half	-0.41%	-0.41%	-0.70%	-0.48%	-0.44%	-0.78%
6. Cap 5+CP-HP	1.57%	4.63%	14.05%	1.91%	5.67%	17.30%
7. Cap 20+CP-HP	-0.27%	4.80%	14.07%	-0.30%	7.43%	17.32%

[a] All the price impacts are measured in real terms and all the percentages are changes from baseline level.
[b] The production cost increases of the power sector due to the purchase of any allowances (or the allowance cost the power sector may pass through to its customers) are not included in the calculation in this table.

Table 4. Petroleum Price Impacts of WCI Policy Scenarios (without allowance cost effect) [a, b]

	Residential Gasoline Price Change (% change for selected years)			Delivered Price Change Refined Petroleum Products[c] (% change for selected years)		
Scenario	2012	2015	2020	2012	2015	2020
1. Complementary	0.04%	0.14%	0.27%	0.06%	0.23%	0.45%
2. Cap 5+CP	0.04%	0.14%	0.27%	0.06%	0.23%	0.46%
3. Cap 20+CP	0.04%	0.18%	0.31%	0.06%	0.25%	0.47%
4. Cap 40+CP	0.04%	0.21%	0.34%	0.07%	0.26%	0.50%
5. Cap 50+CP-Half	0.03%	0.21%	0.33%	0.05%	0.23%	0.45%
6. Cap 5+CP-HP	0.04%	0.14%	0.28%	0.07%	0.25%	0.52%
7. Cap 20+CP-HP	0.04%	0.18%	0.31%	0.06%	0.26%	0.54%

[a] The impacts in this table do not include the direct or indirect production cost increases due to the need of the Petroleum Refining sector to purchase any allowances.
[b] All the price impacts are measured in real terms and all the percentages are changes from baseline level.
[c] Also includes a small amount of refined coal products.

Table 5. Tax Revenue Impacts of WCI Policy Scenarios

Scenario	2012	2015	2020
1. Complementary	0.032%	-0.006%	0.029%
2. Cap 5+CP	0.033%	-0.025%	0.000%
3. Cap 20+CP	0.035%	-0.082%	-0.110%
4. Cap 40+CP	0.046%	-0.170%	-0.231%
5. Cap 50+CP-Half	0.020%	-0.255%	-0.368%
6. Cap 5+CP-HP	0.018%	-0.125%	-0.200%
7. Cap 20+CP-HP	0.024%	-0.178%	-0.299%

Table 6. Major Sectoral Impacts of WCI Policy Scenarios
(top 3 positive and negative impacted sectors in terms of absolute GSP impacts)

2012	2015	2020
1. Complementary		
Top 3 Positive Impact		
Offices of health practitioners	Offices of health practitioners	Offices of health practitioners
Real estate	Real estate	Retail trade
Telecommunications	Electric power generation, transmission, and distribution	Electric power generation, transmission, and distribution
Top 3 Negative Impact		
Automotive repair and maintenance	Automotive repair and maintenance	Construction
Wholesale trade	Construction	Petroleum refining
Coal mining	Coal mining	Coal mining
2. Cap 5+CP		
Top 3 Positive Impact		
Offices of health practitioners	Offices of health practitioners	Offices of health practitioners
Real estate	Real estate	Retail trade
Telecommunications	Electric power generation, transmission, and distribution	Electric power generation, transmission, and distribution
Top 3 Negative Impact		
Automotive repair and maintenance	Automotive repair and maintenance	Construction
Wholesale trade	Construction	Petroleum refining
Coal mining	Coal mining	Coal mining
3. Cap 20+CP		
Top 3 Positive Impact		
Offices of health practitioners	Offices of health practitioners	Offices of health practitioners
Real estate	Telecommunications	Retail trade
Telecommunications	Hospitals	Monetary authorities, credit intermediation
Top 3 Negative Impact		
Automotive repair and	Automotive repair and	Construction

maintenance	maintenance	
Wholesale trade	Construction	Real estate
Automotive equipment rental and leasing	Retail trade	Petroleum refining
4. Cap 40+CP		
Top 3 Positive Impact		
Offices of health practitioners	Offices of health practitioners	Offices of health practitioners
Real estate	Hospitals	Automotive repair and maintenance
Telecommunications	Telecommunications	Truck transportation
Top 3 Negative Impact		
Automotive repair and maintenance	Retail trade	Construction
Wholesale trade	Construction	Real estate
Automotive equipment rental and leasing	Automotive repair and maintenance	Electric power generation, transmission, and distribution
5. Cap 50+CP-Half		
Top 3 Positive Impact		
Offices of health practitioners	Household appliance manufacturing	Automotive repair and maintenance
Real estate	Ventilation, heating, air-conditioning, and commercial refrigeration equipment manufacturing	Truck transportation
Electric power generation, transmission, and distribution	Nonmetallic mineral mining and quarrying	Monetary authorities, credit intermediation
Top 3 Negative Impact		
Automotive repair and maintenance	Retail trade	Real estate
Oil and gas extraction	Construction	Construction
Wholesale trade	Real estate	Electric power generation, transmission, and distribution
6. Cap 5+CP-HP		
Top 3 Positive Impact		
Offices of health practitioners	Offices of health practitioners	Offices of health practitioners
Real estate	Real estate	Retail trade
Telecommunications	Telecommunications	Monetary authorities, credit intermediation
Top 3 Negative Impact		
Electric power generation, transmission, and distribution	Electric power generation, transmission, and distribution	Electric power generation, transmission, and distribution
Automotive repair and maintenance	Construction	Petroleum refining
Wholesale trade	Petroleum refining	Construction
7. Cap 20+CP-HP		

Top 3 Positive Impact		
Offices of health practitioners	Offices of health practitioners	Offices of health practitioners
Real estate	Hospitals	Retail trade
Telecommunications	Telecommunications	Automotive repair and maintenance
Top 3 Negative Impact		
Automotive repair and maintenance	Electric power generation, transmission, and distribution	Electric power generation, transmission, and distribution
Electric power generation, transmission, and distribution	Construction	Petroleum refining
Oil and gas extraction	Petroleum refining	Construction

Table 7. Major Sectoral Impacts of WCI Policy Scenarios
(top 3 positive and negative impacted sectors in terms of percentage GSP impacts)

2012	2015	2020
1. Complementary		
Top 3 Positive Impact		
Personal care services	Household appliance manufacturing	Household appliance manufacturing
Other furniture related product manufacturing	Personal care services	Personal care services
Offices of health practitioners	Other furniture related product manufacturing	Private households
Top 3 Negative Impact		
Forestry; Fishing, hunting, trapping	Forestry; Fishing, hunting, trapping	Forestry; Fishing, hunting, trapping
Automotive repair and maintenance	Automotive repair and maintenance	Coal mining
Automotive equipment rental and leasing	Coal mining	Petroleum refining
2. Cap 5+CP		
Top 3 Positive Impact		
Personal care services	Household appliance manufacturing	Household appliance manufacturing
Other furniture related product manufacturing	Personal care services	Personal care services
Offices of health practitioners	Other furniture related product manufacturing	Private households
Top 3 Negative Impact		
Forestry; Fishing, hunting, trapping	Forestry; Fishing, hunting, trapping	Forestry; Fishing, hunting, trapping
Automotive repair and maintenance	Automotive repair and maintenance	Coal mining
Automotive equipment rental and leasing	Coal mining	Petroleum refining

3. Cap 20+CP		
Top 3 Positive Impact		
Personal care services	Household appliance manufacturing	Household appliance manufacturing
Other furniture related product manufacturing	Personal care services	Private households
Offices of health practitioners	Private households	Automotive repair and maintenance
Top 3 Negative Impact		
Forestry; Fishing, hunting, trapping	Forestry; Fishing, hunting, trapping	Forestry; Fishing, hunting, trapping
Automotive repair and maintenance	Automotive repair and maintenance	Petroleum refining
Automotive equipment rental and leasing	Automotive equipment rental and leasing	Motor vehicle manufacturing
4. Cap 40+CP		
Top 3 Positive Impact		
Personal care services	Household appliance manufacturing	Household appliance manufacturing
Other furniture related product manufacturing	Personal care services	Automotive repair and maintenance
Offices of health practitioners	Private households	Private households
Top 3 Negative Impact		
Forestry; Fishing, hunting, trapping	Forestry; Fishing, hunting, trapping	Forestry; Fishing, hunting, trapping
Automotive repair and maintenance	Automotive repair and maintenance	Petroleum refining
Automotive equipment rental and leasing	Automotive equipment rental and leasing	Motor vehicle manufacturing
5. Cap 50+CP-Half		
Top 3 Positive Impact		
Personal care services	Household appliance manufacturing	Automotive repair and maintenance
Other furniture related product manufacturing	Ventilation, heating, air-conditioning, and commercial refrigeration equipment manufacturing	Household appliance manufacturing
Offices of health practitioners	Agriculture, construction, and mining machinery manufacturing	Automotive equipment rental and leasing
Top 3 Negative Impact		
Forestry; Fishing, hunting, trapping	Forestry; Fishing, hunting, trapping	Forestry; Fishing, hunting, trapping
Automotive repair and maintenance	Automotive repair and maintenance	Petroleum refining
Engine, turbine, power transmission equipment mfg	Automotive equipment rental and leasing	Pulp, paper, and paperboard mills

6. Cap 5+CP-HighPrice		
Top 3 Positive Impact		
Personal care services	Household appliance manufacturing	Household appliance manufacturing
Other furniture related product manufacturing	Personal care services	Personal care services
Offices of health practitioners	Private households	Private households
Top 3 Negative Impact		
Engine, turbine, power transmission equipment manufacturing	Forestry; Fishing, hunting, trapping	Petroleum refining
Forestry; Fishing, hunting, trapping	Petroleum refining	Forestry; Fishing, hunting, trapping
Automotive repair and maintenance	Automotive repair and maintenance	Electric power generation, transmission, and distribution
7. Cap 20+CP- HighPrice		
Top 3 Positive Impact		
Personal care services	Household appliance manufacturing	Household appliance manufacturing
Other furniture related product manufacturing	Personal care services	Automotive repair and maintenance
Offices of health practitioners	Private households	Private households
Top 3 Negative Impact		
Engine, turbine, power transmission equipment manufacturing	Forestry; Fishing, hunting, trapping	Petroleum refining
Forestry; Fishing, hunting, trapping	Petroleum refining	Forestry; Fishing, hunting, trapping
Automotive repair and maintenance	Automotive repair and maintenance	Electric power generation, transmission, and distribution

relate to household spending and the implement of renewable energy. It is very difficult to project the mixture of gas vs. coal generation. Natural gas prices have fluctuated sharply in the past and are likely to continue doing so. Coal prices have been relatively stable in comparison, but additions to coal capacity are highly uncertain. Some post-2005 planned or committed coal plants in the region are already operating or scheduled to start operating soon (see, Randazzo, 2010; O'Grady, 2010), while others such as Desert Rock have encountered major obstacles (Gardner, 2009).

The results of each case for each year of the planning horizon and for a broader set of economic indicators are presented in the tables in Appendix C. In all the cases, the impacts start out positive in Year 2010. In Cases 1 and 2, the impacts are positive throughout the whole planning horizon. The positive impacts decrease starting in Year 2012 and reach a trough in 2016. Then the positive impacts climb up gradually and reach the highest level in the Year 2020. In Cases 3 to 7, the positive impacts decrease starting from Year 2012. The impacts turn negative starting from 2014 and remain negative through Year 2020.

Table 8 presents the impacts on GHG emissions from NM in the Year 2020 for the seven policy cases. The first numerical column shows the baseline emissions, which are 71.6 MMtCO2e (see the ENERGY

Table 8. GHG Emission Reductions by Policy Case, Year 2020 (all emissions are in MMtCO2e)

Policy Case	Year 2020 Baseline Emissions	Year 2020 Emissions Target (10% below 2000 level)[a]	ENERGY2020 Post-Policy Emissions		Emissions after REMI Macro Run	
			Level	Reduction	Level	Reduction
1. Complementary	71.6	63.99	70.07	1.53	69.98	1.62
2. Cap 5+CP	71.6	63.99	69.74	1.86	69.64	1.96
3. Cap 20+CP	71.6	63.99	70.25	1.35	70.09	1.51
4. Cap 40+CP	71.6	63.99	70.03	1.57	69.80	1.80
5. Cap 50+CP-Half	71.6	63.99	70.47	1.13	70.13	1.47
6. Cap 5+CP-HP	71.6	63.99	69.27	2.33	68.10	3.50
7. Cap 20+CP-HP	71.6	63.99	69.13	2.47	67.91	3.69

[a] Year 2000 production-based emissions (excluding sinks and emissions from Indian lands) are 71.1 MMtCO2e.

2020 modeling results in ICF, 2010). The second numerical column shows the emissions target for Year 2020. New Mexico's emission reduction target is established as 10% below Year 2000 level by the Year 2020. New Mexico Year 2000 production-based gross emissions level (excluding forestry and land use sinks and emissions from Indian lands) was 71.1 MMtCO2e. This is computed by using the ENERGY 2020 estimate of Year 2007 emissions, adjusted by the 2000-2007 emission growth rates in the updated NM GHG Inventory Report (NMED, 2010). The Year 2020 emissions target is then calculated as 63.99 MMtCO2e (or an emission reduction target of 7.61 MMtCO2e). The third and fourth columns show the ENERGY 2020 post-policy GHG emissions level and the emission reductions achieved (which is the difference between the baseline emissions level and the ENERGY 2020 post-policy emissions level). From these two columns we can see that there are only slight differences in New Mexico GHG emission reductions achieved across the seven simulated policy cases. In all the cases, New Mexico reduces emissions between 1.5 and 3.7 MMtCO2e through its own mitigation activities (or 19 percent to 48 percent of the of total emission reduction target of 7.61 MMtCO2e). None of the scenarios has a sufficiently high allowance price to incentivize facilities to implement emission reduction options to meet the emission reduction requirement proposed by the Environment Department. Instead the more cost-effective way for NM sources to meet their compliance obligation is to purchase emission allowances from within the WCI. So, while the regional emission reduction target will be met, the state emission reduction target will not under the seven scenarios alone. It is to be expected in any cap-and-trade program that some jurisdictions will be net buyers and others will be net sellers of allowances. The geography of the emission reduction is not important because GHGs are global pollutants, i.e., mitigation is equally effective at any location. This is one of the main advantages of cap and trade vs. command and control because it promotes use of the lowest cost options in general, and with no need to be concerned about the geographic concentration of emissions ("hot spots") in the case of GHGs. This is the result of the New Mexico marginal abatement cost curve being relatively steep compared with its WCI partners. Therefore, New Mexico would choose to mitigate emissions only up to the point where its marginal cost equals the allowance price. At this point, it is cheaper, or more cost-effective, for the facilities to purchase emission allowances from within the WCI to meet their remaining compliance obligation. In meeting the regional reduction target, some of the relatively low-cost partners will mitigate more emissions than the regional reduction target indicates and sell allowances in a secondary market. For the WCI region as a whole, the overall emission reduction goal will be achieved at an equilibrium allowance price of $33/tCO2e in the base (main) policy case. The ENERGY 2020 modeling results for different allowance price levels indicate that New Mexico would meet its entire reduction goal by its own

mitigation efforts only when the allowance price exceeds $100/tCO2e in the base case. Of course, with such a high allowance price level, the WCI region will over-comply with the Year 2020 emission reduction target because all the partners will excessively reduce emissions through mitigation activities to avoid paying the high price to purchase allowances for any unabated emissions.

The last column of Table 8 presents the influence of the macroeconomic effects on NM emissions in the year 2020 (projections are based on a combination of GHG emission coefficients from ENERGY2020 and sectoral outputs from the REMI macro simulations) and the total emission reductions after taking the macroeconomic effects into account. In all seven cases, the change in macroeconomic activities further reduces the GHG emissions, though by no more than 2 percent. In the Complementary and Cap 5+CP cases, although the gross output of the economy increases slightly in the Year 2020, because the economic structure shifts to less emission-intensive sectors (such as increased output from some service sectors and decreased output from some manufacturing sectors), the economy-wide emissions decline. The two High-Price cases have the largest macroeconomic impacts on emissions. The first reason is that the total output decreases more in these two cases than in the other cases. The second reason is that because of the high energy price assumptions, the energy supply sectors (e.g., Electric Power and the Petroleum Refining sectors) are mostly negatively affected in these cases. The emission coefficients of these sectors are much higher than expanded service and trade sectors (e.g., Offices of Health Practitioners and Retail Trade sectors).

The results presented here are consistent with results found by the authors in other states (see, e.g., Rose and Wei, 2009, 2010a; Miller et al., 2010). However, the modeling approach used in this analysis provided more conservative input data and took into consideration C&T, leading to somewhat more conservative impacts than those found in such states as Florida, Pennsylvania and Michigan.

VI. Conclusion

This study summarizes the analysis of the impacts of the Western Climate Initiative Phase 3 policies on the New Mexico economy. We used a state of the art macroeconometric model known as REMI PI^{+} to perform this analysis. The analysis is based on data obtained from the State of New Mexico Environment Department and ICF International, Inc., on simulations of direct economic impacts of these policies.

Among the seven policy cases we evaluated, the aggregate Complementary Policies case and the base Cap and Trade policy case with a relatively low allowance price (Cap 5+CP case) yield slightly positive impacts on the State's economy over the planning horizon. The increase in Net Present Value of Gross State Product is about $600 million in each case and the increase of employment in Year 2020 is between 2 to 2.5 thousand full-time equivalent jobs. The analysis on the base C&T policy case with a relatively high allowance price, the policy case involving less effective implementation of complementary policies and the cases with assumptions of higher energy prices and construction costs all yield slightly negative impacts to the economy.

The current NM policy proposal intends to freely grant all the greenhouse gas emission allowances. Although because of the data limitation of the ENERGY 2020 simulations, we cannot model an allowance free-granting case directly, we conclude that the impacts of the current NM climate legislation should fall somewhere between the Complementary Policies case (no allowance trading case) and the Cap 5+CP case (lowest allowance price case). Therefore, our best estimate of the impacts of the proposed implementation of the Western Climate Initiative Policy Case on the New Mexico economy is a slightly positive impact on the order of approximately one-tenth to two-tenths of one percent (0.001 to 0.002) on major economic indicators over the course of the planning horizon and in the terminal Year 2020.

The economic gains stem primarily from the ability of mitigation options to lower the cost of production. This stems primarily from their ability to improve energy efficiency and thus lower production costs and higher consumer purchasing power. The results also stem from the stimulus of increased investment in energy-saving equipment.

Note that the estimates of economic benefits reported in this study represent a lower bound from a broader perspective. They do not include the avoidance of damage from the climate change that continued baseline GHG emissions would bring forth, the reduction in damage from the associated decrease in ordinary pollutants, the reduction in the use of natural resources, the reduction in traffic congestion, etc.

Overall, the findings from this study suggest that implementing the proposed NM climate change policy would generate small but positive net economic impacts to the State's economy.

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APPENDIX A. Description of the REMI PI^{+} Model

REMI PI^{+} is a structural economic forecasting and policy analysis model. It integrates input-output, computable general equilibrium, econometric and economic geography methodologies. The model is dynamic, with forecasts and simulations generated on an annual basis and behavioral responses to wage, price, and other economic factors.

The REMI model consists of thousands of simultaneous equations with a structure that is relatively straightforward. The exact number of equations used varies depending on the extent of industry, demographic, demand, and other detail in the model. The overall structure of the model can be summarized in five major blocks: (1) Output and Demand, (2) Labor and Capital Demand, (3) Population and Labor Supply, (4) Compensation, Prices, and Costs, and (5) Market Shares. The blocks and their key interactions are shown in Figures A1 and A2.

The Output and Demand block includes output, demand, consumption, investment, government spending, import, product access, and export concepts. Output for each industry is determined by industry demand in a given region and its trade with the US market, and international imports and exports. For each industry, demand is determined by the amount of output, consumption, investment, and capital demand on that industry. Consumption depends on real disposable income per capita, relative prices, differential income elasticities and population. Input productivity depends on access to inputs because the larger the choice set of inputs, the more likely that the input with the specific characteristics required for the job will be formed. In the capital stock adjustment process, investment occurs to fill the difference between optimal and actual capital stock for residential, non-residential, and equipment investment. Government spending changes are determined by changes in the population.

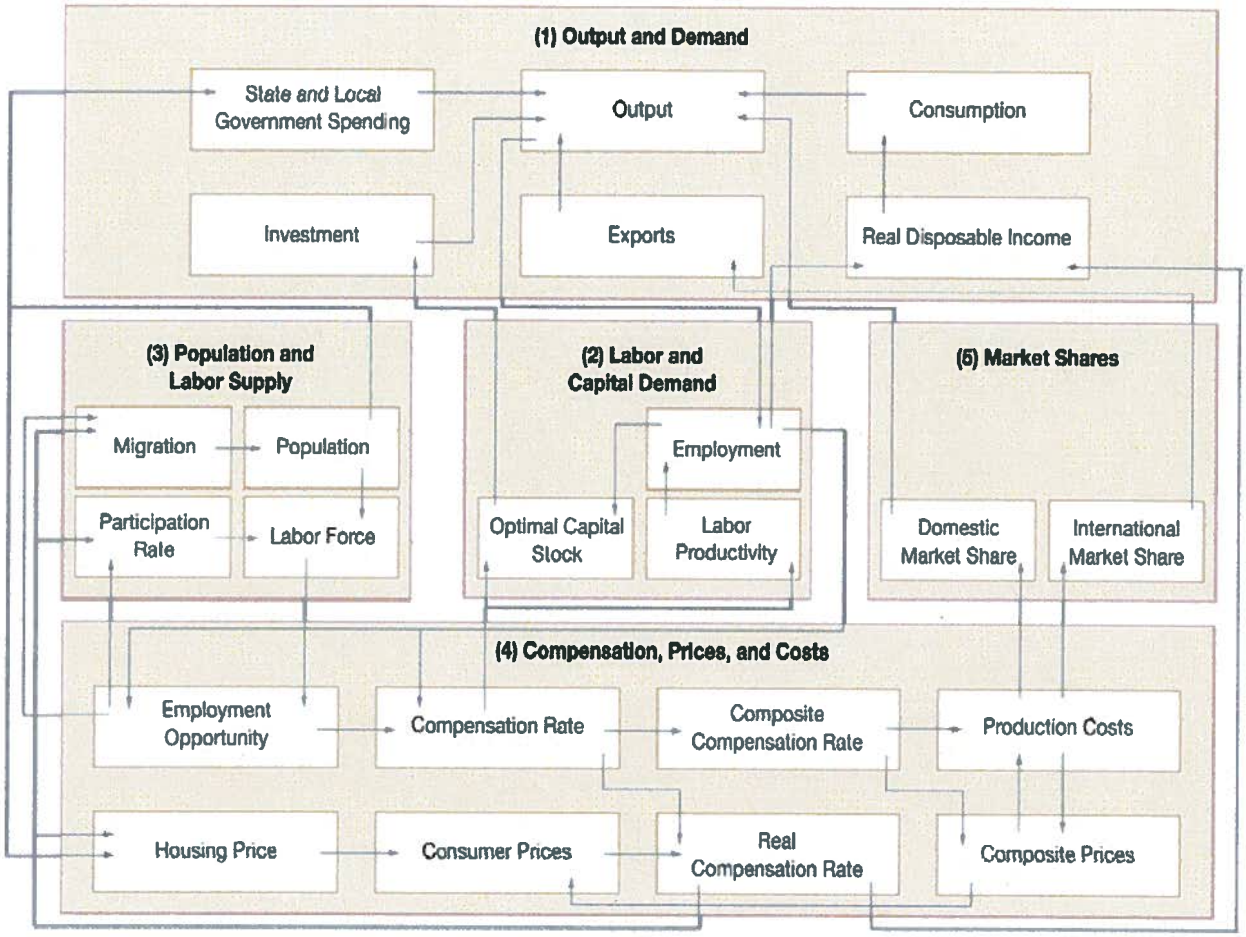
The Labor and Capital Demand block includes the determination of labor productivity, labor intensity and the optimal capital stocks. Industry-specific labor productivity depends on the availability of workers with differentiated skills for the occupations used in each industry. The occupational labor supply and commuting costs determine firms' access to a specialized labor force.

Labor intensity is determined by the cost of labor relative to the other factor inputs, capital and fuel. Demand for capital is driven by the optimal capital stock equation for both non-residential capital and equipment. Optimal capital stock for each industry depends on the relative cost of labor and capital, and the employment weighted by capital use for each industry. Employment in private industries is determined by the value added and employment per unit of value added in each industry.

The Population and Labor Supply block includes detailed demographic information about the region. Population data is given for age and gender, with birth and survival rates for each group. The size and labor force participation rate of each group determines the labor supply. These participation rates respond to changes in employment relative to the potential labor force and to changes in the real after tax compensation rate. Migration includes retirement, military, international and economic migration. Economic migration is determined by the relative real after tax compensation rate, relative employment opportunity and consumer access to variety.

The Compensation, Prices, and Costs block includes delivered prices, production costs, equipment cost, the consumption deflator, consumer prices, the price of housing, and the wage equation. Economic geography concepts account for the productivity and price effects of access to specialized labor, goods and services.

Figure A1. REMI Model Linkages (Excluding Economic Geography Linkages)

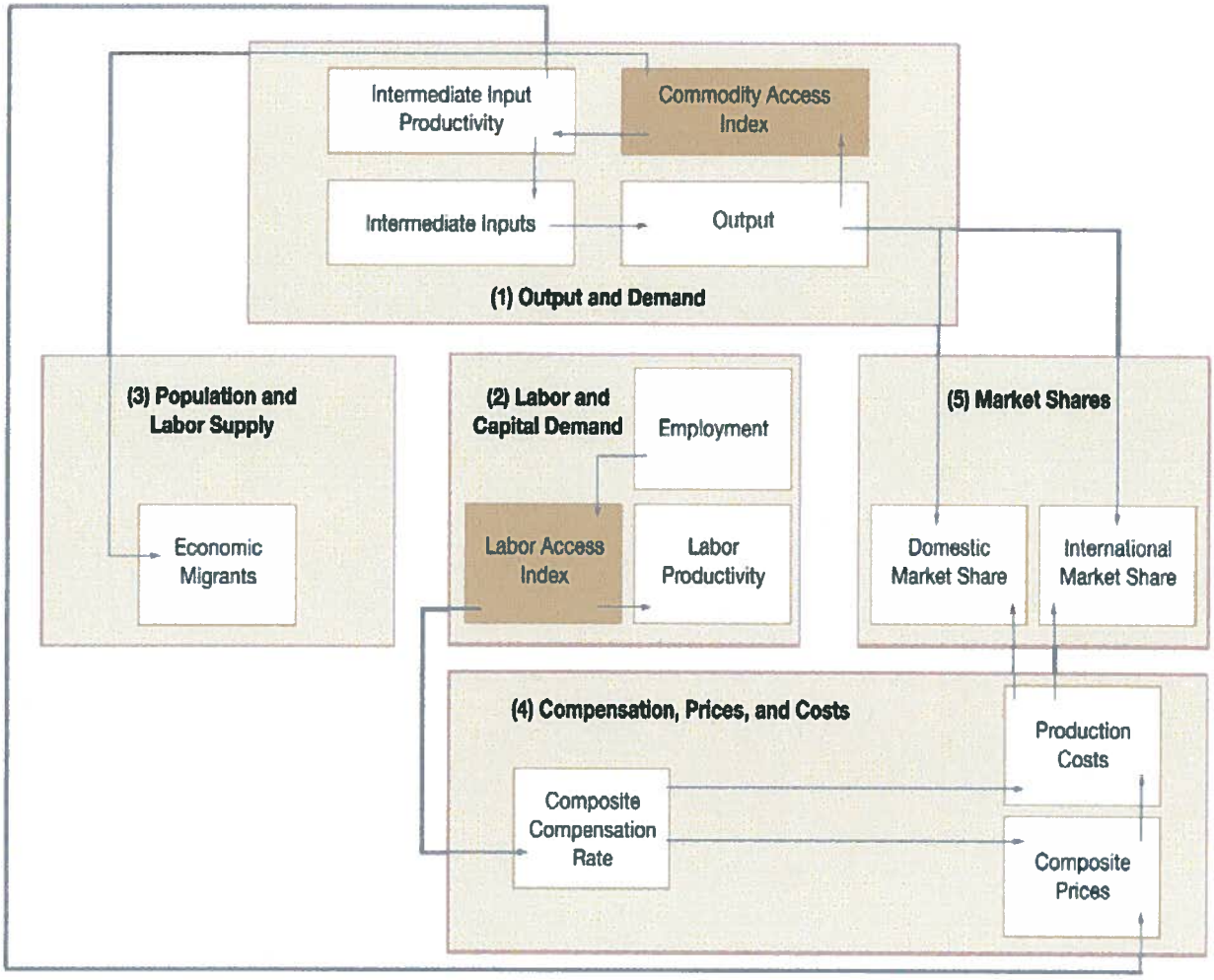


These prices measure the value of the industry output, taking into account the access to production locations. This access is important due to the specialization of production that takes place within each industry, and because transportation and transaction costs associated with distance are significant. Composite prices for each industry are then calculated based on the production costs of supplying regions, the effective distance to these regions, and the index of access to the variety of output in the industry relative to the access by other uses of the product.

The cost of production for each industry is determined by cost of labor, capital, fuel and intermediate inputs. Labor costs reflect a productivity adjustment to account for access to specialized labor, as well as underlying compensation rates. Capital costs include costs of non-residential structures and equipment, while fuel costs incorporate electricity, natural gas and residual fuels.

The consumption deflator converts industry prices to prices for consumption commodities. For potential migrants, the consumer price is additionally calculated to include housing prices. Housing price changes from their initial level depend on changes in income and population density. Regional employee compensation changes are due to changes in labor demand and supply conditions, and changes in the national compensation rate. Changes in employment opportunities relative to the labor force and occupational demand change determine compensation rates by industry.

Figure A2. Economic Geography Linkages



The Market Shares equations measure the proportion of local and export markets that are captured by each industry. These depend on relative production costs, the estimated price elasticity of demand, and effective distance between the home region and each of the other regions. The change in share of a specific area in any region depends on changes in its delivered price and the quantity it produces compared with the same factors for competitors in that market. The share of local and external markets then drives the exports from and imports to the home economy.

As shown in Figure A2, the Labor and Capital Demand block includes labor intensity and productivity, as well as demand for labor and capital. Labor force participation rate and migration equations are in the Population and Labor Supply block. The Compensation, Prices, and Costs block includes composite prices, determinants of production costs, the consumption price deflator, housing prices, and the wage equations. The proportion of local, interregional and international markets captured by each region is included in the Market Shares block.

Appendix B. REMI Model Reconciliation

This section describes the approaches used to reconcile the Energy 2020 and REMI PI$^+$ models such that both models are generating equitable baseline projections. It is important that both models form similar baseline projections, as impacts are generated from comparisons to baselines on the assumptions of policy changes. Two segments were considered for reconciliation. The first segment includes economic growth by sector, while the second segment includes energy consumption. Because the two models share many common measures, the REMI PI$^+$ model can be reconciled to reflect baseline projections of the Energy 2020 model. However, since modeling philosophies and foci differ between the two models, some limitations to the detail that can be reconciled exist. The reconciliation task concludes with both models generating similar sectoral growth in output, of gross regional product, personal income, population and proximally equal energy use over common forecast horizons. Because both models made comparable projections of personal income, population, and fuel consumption projections, these segments of the REMI PI$^+$ model remained unchanged. Table B1 shows the pre-reconciliation and post-reconciliation REMI PI$^+$ model projected growth rates for comparison with those of Energy 2020. The results shown in Table B1 suggest that the reconciled REMI PI$^+$ model is adequately tracking the Energy 2020 projections.

Table B1 Baseline Growth Rates 2010-2030

	Pre-Reconciliation REMI PI$^+$	Reconciled REMI PI$^+$	Energy 2020
Gross Regional Product	1.4%	2.2%	2.3%
Industry Output	0.1%	2.7%	2.8%
Commercial Output	2.1%	2.5%	2.6%
Population	0.9%	0.9%	0.8%
Personal Income	2.1%	2.1%	2.3%
Fuel Consumption*	2.5%	2.5%	2.5%

**Reconciled over the period of 2010-2020*

The Energy 2020 model is a detailed fuel supply and demand model for modeling energy policy impacts on energy markets and economic activity. Baseline projections of key economic variables drive fuel demands over the long-term forecast horizon of the model. That is, population and economic activity projections drive simulated demands for various fuels and energy feedstocks. The model is built on three integrated modules including an emissions, an energy demand and an energy supply module. The fuel supply and demand modules interact to determine fuel prices, investment in energy resources necessary to keep pace with demand, and emissions. Policies that impact fuel markets, in turn, influence the macroeconomy. However, the Energy 2020 model simulations only anticipate direct impacts on key macroeconomic variables and do not take into account secondary impacts that arise through indirect and induced effects. Because the REMI PI$^+$ model provides a richer set of policy simulation options for modeling secondary impacts, Energy 2020 simulations are imposed on to the REMI PI$^+$ model for simulating macroeconomic effects of energy sector changes. Policy simulations of the macroeconomic outcomes are therefore derived by imposing the direct effects of the Energy 2020 model on to the REMI PI$^+$ model's baseline projections. The differences in the policy simulation values from baseline values indicate the size of the impacts on REMI PI$^+$ policy variables such as employment and gross regional product. Because both models start from similar economic baseline projections, we are assured that the outcomes are valid representations of expected macroeconomic outcomes of energy policy changes.

Baseline REMI PI$^+$ projections must first be modified to fit the baseline projections of fuel expenditures and economic activity used in Energy 2020. Starting with economic activity, we match the 36 sector output projections from the Energy 2020 to the 169 REMI PI$^+$ sectors. Table B2 shows the REMI PI$^+$ sector aggregations that map to the Energy 2020 sectors. Sector forecasts of both models are compared in real dollar values. REMI PI$^+$ baseline projections are adjusted using the *Regional Control* policy

variables for *Industry Sales/Exogenous Production (amount)* of the corresponding REMI PI$^+$ sectors, such that the REMI PI$^+$ sector aggregates provide comparable average annual growth projections from 2010 to 2030 as those provided by Energy 2020.

First, sector average annual growth rates of output from 2010 to 2030 are calculated for each model. The 2030 output of the REMI PI$^+$ sector is adjusted to reflect the Energy 2020 projected growth rate. A line is fitted between the 2010 value and the adjusted 2030 value. The difference between the fitted values and the REMI PI$^+$ projected values in intermediate years provides the total sector adjustment for each year between 2010 and 2030. The total sector adjustment by year is then allocated to each industry in the sector proportionately to the size of the industry. The sector adjustments are then read into the REMI PI$^+$ model and it is re-solved to establish the new baseline forecast. This process was repeated twice to reach a convergence in sector growth rates. The resulting REMI PI$^+$ economic projections then reflect the projections assumed in the Energy 2020 model.

Next, the energy components of both models are compared. Because the Energy 2020 model is an energy demand and production simulation model, whereas the REMI PI$^+$ model is an economic and policy impact simulation model, the treatment of energy sectors in both models differ substantially. The Energy 2020 model has detailed treatment of fuel consumption, supply, and prices. In this the interaction of the quantity of fuel supplied and demanded, interact with capacity and policy constraints to establish fuel prices. Increases in fuel prices spark investment in efficiency and energy production. Alternatively, the REMI PI$^+$ model treats energy as a factor of production, whose relative cost to other regions reflects on the model region's competitiveness in the global economy. Rather than breaking energy consumption out into detailed fuel components, it aggregates energy into a single relative energy cost for its 169 commercial and industrial sectors. Hence, the REMI PI$^+$ model lacks the underlying structure of energy markets, but provides comprehensive simulations of the interaction of individual sectors and institutions that make up the local economy.

REMI PI$^+$ does not explicitly model the demand for fuel (Treyz, Rickman and Shao, 1992). Instead a single composite factor fuel is modeled as a substitute for labor and capital within a Cobb-Douglas production function. REMI PI$^+$ simulates changes in fuel's share of total factor inputs as the change of relative cost of fuel. That is, value added output for sector *i* is modeled as,

$$VA_i = A_i(E_i)^{\alpha_i}(K_i)^{\beta_i}(F_i)^{\gamma_i}$$

where A is total factor productivity, E is labor, K is capital and F is fuel. The fixed coefficients, α, β and γ sum to unity. Optimizing and solving for cost minimizing labor provides,

$$E_i = (1/A_i)(w_i/\alpha_i)^{\alpha_i-1}(c_i/\beta_i)^{\beta_i}(f/\gamma_i)^{\gamma_i}VA_i$$

Doing the same for national VA and dividing provides,

$$E_i = (1/RFPROD_i)(RLC_i)^{\alpha_i-1}(RCC_i)^{\beta_i}(RFC_i)^{\gamma_i}(E_i^U/VA_i^U)VA_i$$

Where RFPROD is the ratio of state to national total factor productivities, RLC is the relative labor cost, RCC is the relative cost of capital and RFC is the relative fuel cost. A similar expression can be expressed for capital (K). However, F is not explicitly modeled. The RFC is simply set to a constant for the baseline. It is greater than one if state fuel costs are higher than the national and less than one if lower. For New Mexico, the ratio is 0.825, suggesting that residents and businesses generally spend about 17.5 percent less per unit of energy than the national average. Policy levers that increase the cost of

fuel will increase the demand for labor and capital. Relative fuel prices are not endogenous in the REMI PI$^+$ model. In fact, the REMI PI$^+$ model does not track the absolute price of fuel – leading many user of the REMI PI$^+$ model to rely on energy models to provide inputs to the REMI PI$^+$ model. Because relative production costs are used to drive regional competitiveness, the model traces cost changes relative to the national average when modeling regional product demand; where national costs are set to unity.

Because only relative fuel prices and costs are used in the REMI PI$^+$ model, there are limited options to reconcile REMI's treatment of fuel cost on a sector basis. However, a simple exercise provides sector energy cost as a share of sector total cost using the internal input-output table and sector output. This provided estimated total sector expenditures on energy (not necessarily fuel). Aggregating REMI PI$^+$ sector energy expenditures to Energy 2020 aggregates and calculating correlations between the two models suggested little correspondence between the two (correlation <0.20). Much of this difference may reflect different approaches to accounting for fuel expenditures, but also reflects different concepts of energy consumption within an economic system. While cost of energy enters the REMI PI$^+$ production process, expenditures on fuel are generally treated as interindustry purchases along the Input-Output table. These transactions for fuel are reflected in purchase of and from utilities, petroleum mining, refineries, and other fuel-generating sectors. Differences in the treatment of fuel costs render sector-by-sector comparisons unachievable. However, when aggregating fuel cost as a share of sector cost and trending over time, the REMI PI$^+$ and Energy 2020 models project equal annual growth rates of energy consumption over the range 2010 and 2020 of 2.5 percent. Hence, both models are projecting similar trends in energy consumption from two very different approaches of tracking energy and fuel consumption. Therefore, no adjustments were made to the REMI PI$^+$ projections of fuel consumption or prices.

Table B2 Mapping of ENERGY 2020 sectors and REMI sectors

	Energy 2020 Sector	REMI Sectors
1	Transportation Services	Air transportation Rail transportation Water transportation Truck transportation Couriers and messengers Transit and ground passenger transportation Scenic and sightseeing transportation and support activities for transportation Warehousing and storage
2	Pipelines	Pipeline transportation
3	Communication	Newspaper, periodical, book, and directory publishers Software publishers Motion picture and sound recording industries Internet and other information services Broadcasting (except internet) Telecommunications
4	Utilities	Electric power generation, transmission, and distribution Natural gas distribution Water, sewage, and other systems
5	Wholesale	Wholesale trade
6	Retail	Retail trade
7	FIRE	Monetary authorities, credit intermediation Funds, trusts, and other financial vehicles Securities, commodity contracts, and other financial investments and related activities Insurance carriers Agencies, brokerages, and other insurance related activities Real estate Automotive equipment rental and leasing Consumer goods rental and general rental centers Commercial and industrial machinery and equipment rental and leasing Lessors of nonfinancial intangible assets
8	Offices - Business Services	Legal services Accounting, tax preparation, bookkeeping, and payroll services Architectural, engineering, and related services Specialized design services Computer systems design and related services Management, scientific, and technical consulting services Scientific research and development services; Other professional, scientific, and technical services Advertising and related services Management of companies and enterprises Office administrative services; Facilities support services Employment services
		Business support services; Investigation and security services; Other support services Travel arrangement and reservation services Services to buildings and dwellings Waste collection; Waste treatment and disposal and waste management services

	Energy 2020 Sector	REMI Sectors
9	Education	Elementary and secondary schools; Junior colleges, colleges, universities, and professional schools; Other educational services
10	Health & Social	Offices of health practitioners Outpatient, laboratory, and other ambulatory care services Home health care services Hospitals Nursing care facilities Residential care facilities Individual, family, community, and vocational rehabilitation services Child day care services
11	Food, Lodging, Recreation	Performing arts companies; Promoters of events, and agents and managers Spectator sports Independent artists, writers, and performers Museums, historical sites, and similar institutions Amusement, gambling, and recreation industries Accommodation Food services and drinking places
12	Food & Tobacco	Animal food manufacturing Grain and oilseed milling Sugar and confectionery product manufacturing Fruit and vegetable preserving and specialty food manufacturing Dairy product manufacturing Animal slaughtering and processing Seafood product preparation and packaging Bakeries and tortilla manufacturing Other food manufacturing Beverage manufacturing Tobacco manufacturing
13	Textiles	Fiber, yarn, and thread mills Fabric mills Textile and fabric finishing and fabric coating mills Textile furnishings mills Other textile product mills
14	Apparel	Apparel knitting mills Cut and sew apparel manufacturing Apparel accessories and other apparel manufacturing
15	Lumber	Sawmills and wood preservation Veneer, plywood, and engineered wood product manufacturing Other wood product manufacturing
16	Furniture	Household and institutional furniture and kitchen cabinet manufacturing Office furniture (including fixtures) manufacturing Other furniture related product manufacturing
17	Paper	Pulp, paper, and paperboard mills Converted paper product manufacturing
18	Printing	Printing and related support activities
19	Chemical	Basic chemical manufacturing Resin, synthetic rubber, and artificial synthetic fibers and filaments manufacturing
		Pesticide, fertilizer, and other agricultural chemical manufacturing Pharmaceutical and medicine manufacturing Paint, coating, and adhesive manufacturing

	Energy 2020 Sector	REMI Sectors
		Soap, cleaning compound, and toilet preparation manufacturing Other chemical product and preparation manufacturing Plastics product manufacturing
20	Petroleum Products	Petroleum and coal products manufacturing
21	Rubber	Rubber product manufacturing
22	Leather	Leather, hide tanning, finishing; Other leather, allied product manufacturing Footwear manufacturing
23	Nonmetallic Minerals	Clay product and refractory manufacturing Glass and glass product manufacturing Cement and concrete product manufacturing Lime, gypsum product manufacturing; Other nonmetallic mineral product manufacturing
24	Primary Metals	Iron and steel mills and ferroalloy manufacturing Steel product manufacturing from purchased steel Alumina and aluminum production and processing Nonferrous metal (except aluminum) production and processing Foundries Forging and stamping
25	Fabricated Metals	Cutlery and handtool manufacturing Architectural and structural metals manufacturing Boiler, tank, and shipping container manufacturing Hardware manufacturing Spring and wire product manufacturing Machine shops; turned product; and screw, nut, and bolt manufacturing Coating, engraving, heat treating, and allied activities Other fabricated metal product manufacturing
26	Machines	Agriculture, construction, and mining machinery manufacturing Industrial machinery manufacturing Commercial and service industry machinery manufacturing Ventilation, heating, air-conditioning, and commercial refrigeration equipment manufacturing Metalworking machinery manufacturing Engine, turbine, power transmission equipment manufacturing Other general purpose machinery manufacturing
27	Computers	Computer and peripheral equipment manufacturing
28	Electric Equipment	Communications equipment manufacturing Audio and video equipment manufacturing Semiconductor and other electronic component manufacturing Navigational, measuring, electromedical, and control instruments manufacturing Manufacturing and reproducing magnetic and optical media Electric lighting equipment manufacturing Household appliance manufacturing Electrical equipment manufacturing Other electrical equipment and component manufacturing
29	Transport Equipment	Motor vehicle manufacturing Motor vehicle body and trailer manufacturing Motor vehicle parts manufacturing Aerospace product and parts manufacturing Railroad rolling stock manufacturing
		Ship and boat building

Energy 2020 Sector		REMI Sectors
		Other transportation equipment manufacturing
30	Other Manufacturing	Medical equipment and supplies manufacturing Other miscellaneous manufacturing
31	Mining Except Oil & Gas	Nonmetallic mineral mining and quarrying Support activities for mining Coal mining Metal ore mining
32	Oil & Gas Extraction	Oil and gas extraction
33	Construction	Construction
34	Forestry	Forestry; Fishing, hunting, trapping
35	Agriculture	Logging Support activities for agriculture and forestry
36	other Services	Automotive repair and maintenance Electronic and precision equipment repair and maintenance Commercial and industrial equipment (except automotive and electronic) repair and maintenance Personal and household goods repair and maintenance Personal care services Death care services Drycleaning and laundry services Other personal services Religious organizations; Grantmaking and giving services, and social advocacy organizations Civic, social, professional, and similar organizations Private households

Appendix C. New Mexico Detailed Simulation Results

Complementary Policies Case

Differences from Baseline

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	NPV 2010-2020
Total Employment	Thousands (Jobs)	0.819	1.312	1.367	1.242	1.087	0.911	0.710	1.134	1.592	2.177	2.579	N/A
Gross Domestic Product	Billions of Fixed (2008) Dollars	0.057	0.088	0.088	0.082	0.073	0.062	0.047	0.059	0.084	0.126	0.150	0.674
Output	Billions of Fixed (2008) Dollars	0.071	0.110	0.105	0.091	0.072	0.049	0.023	0.038	0.068	0.127	0.150	0.676
Population	Thousands	0.354	0.592	0.787	0.915	0.967	0.943	0.844	0.823	0.879	1.028	1.232	N/A
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	0.026	0.043	0.040	0.033	0.023	0.011	-0.003	-0.005	-0.003	0.006	0.014	0.157
PCE-Price Index	2000=100 (Nation)	0.003	0.005	0.019	0.031	0.047	0.064	0.084	0.103	0.124	0.151	0.166	N/A

Levels

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Employment	Thousands (Jobs)	1,086.4	1,094.8	1,108.3	1,122.0	1,135.9	1,147.8	1,158.6	1,169.4	1,177.9	1,193.2	1,203.7
Gross Domestic Product	Billions of Fixed (2008) Dollars	69.5	71.1	72.7	74.3	76.0	77.7	79.4	81.1	82.6	84.7	86.5
Output	Billions of Fixed (2008) Dollars	93.7	96.4	99.0	101.7	104.4	107.1	109.9	112.8	115.5	119.0	122.1
Population	Thousands	2,057.6	2,088.9	2,120.6	2,152.4	2,184.5	2,216.7	2,249.0	2,281.6	2,313.8	2,346.9	2,380.6
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	57.6	58.8	60.1	61.5	62.9	64.4	65.8	67.1	68.3	69.6	70.8
PCE-Price Index	2000=100 (Nation)	132.7	136.2	140.0	144.1	148.3	152.8	157.4	162.4	167.5	172.8	178.2

Percent Change

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Employment	Thousands (Jobs)	0.08%	0.12%	0.12%	0.11%	0.10%	0.08%	0.06%	0.10%	0.14%	0.18%	0.21%
Gross Domestic Product	Billions of Fixed (2008) Dollars	0.08%	0.12%	0.12%	0.11%	0.10%	0.08%	0.06%	0.07%	0.10%	0.15%	0.17%
Output	Billions of Fixed (2008) Dollars	0.08%	0.11%	0.11%	0.09%	0.07%	0.05%	0.02%	0.03%	0.06%	0.11%	0.12%
Population	Thousands	0.02%	0.03%	0.04%	0.04%	0.04%	0.04%	0.04%	0.04%	0.04%	0.04%	0.05%
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	0.05%	0.07%	0.07%	0.05%	0.04%	0.02%	0.00%	-0.01%	0.00%	0.01%	0.02%
PCE-Price Index	2000=100 (Nation)	0.00%	0.00%	0.01%	0.02%	0.03%	0.04%	0.05%	0.06%	0.07%	0.09%	0.09%

Cap 5+CP Case

Differences from Baseline

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	NPV 2010-2020
Total Employment	Thousands (Jobs)	0.823	1.311	1.354	1.227	0.824	0.584	0.388	0.792	1.235	1.787	2.171	N/A
Gross Domestic Product	Billions of Fixed (2008) Dollars	0.057	0.088	0.088	0.082	0.055	0.038	0.021	0.031	0.054	0.091	0.112	0.542
Output	Billions of Fixed (2008) Dollars	0.072	0.110	0.103	0.089	0.047	0.016	-0.013	-0.003	0.025	0.077	0.096	0.488
Population	Thousands	0.354	0.592	0.788	0.920	0.906	0.811	0.647	0.563	0.557	0.642	0.782	N/A
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	0.026	0.043	0.040	0.034	0.014	0.000	-0.015	-0.019	-0.018	-0.011	-0.005	0.093
PCE-Price Index	2000=100 (Nation)	0.003	0.005	0.016	0.027	0.052	0.069	0.089	0.107	0.129	0.156	0.172	N/A

Levels

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Employment	Thousands (Jobs)	1,086.4	1,094.8	1,108.3	1,122.0	1,135.7	1,147.5	1,158.3	1,169.0	1,177.6	1,192.8	1,203.3
Gross Domestic Product	Billions of Fixed (2008) Dollars	69.5	71.1	72.7	74.3	75.9	77.6	79.4	81.0	82.5	84.7	86.5
Output	Billions of Fixed (2008) Dollars	93.7	96.4	99.0	101.7	104.4	107.1	109.9	112.8	115.4	118.9	122.1
Population	Thousands	2,057.6	2,088.9	2,120.6	2,152.4	2,184.4	2,216.6	2,248.8	2,281.3	2,313.5	2,346.5	2,380.1
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	57.6	58.8	60.1	61.5	62.9	64.4	65.8	67.1	68.2	69.6	70.8
PCE-Price Index	2000=100 (Nation)	132.7	136.2	140.0	144.1	148.3	152.8	157.4	162.4	167.5	172.8	178.2

Percent Change

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Employment	Thousands (Jobs)	0.08%	0.12%	0.12%	0.11%	0.07%	0.05%	0.03%	0.07%	0.11%	0.15%	0.18%
Gross Domestic Product	Billions of Fixed (2008) Dollars	0.08%	0.12%	0.12%	0.11%	0.07%	0.05%	0.03%	0.04%	0.07%	0.11%	0.13%
Output	Billions of Fixed (2008) Dollars	0.08%	0.11%	0.10%	0.09%	0.04%	0.02%	-0.01%	0.00%	0.02%	0.07%	0.08%
Population	Thousands	0.02%	0.03%	0.04%	0.04%	0.04%	0.04%	0.03%	0.03%	0.02%	0.03%	0.03%
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	0.05%	0.07%	0.07%	0.06%	0.02%	0.00%	-0.02%	-0.03%	-0.03%	-0.02%	-0.01%
PCE-Price Index	2000=100 (Nation)	0.00%	0.00%	0.01%	0.02%	0.04%	0.05%	0.06%	0.07%	0.08%	0.09%	0.10%

Cap 20+CP Case

Differences from Baseline

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	NPV 2010-2020
Total Employment	Thousands (Jobs)	0.828	1.321	1.423	1.266	0.083	-0.100	-0.343	-0.097	0.169	0.488	0.744	N/A
Gross Domestic Product	Billions of Fixed (2008) Dollars	0.057	0.088	0.093	0.083	0.004	-0.008	-0.037	-0.043	-0.040	-0.029	-0.021	0.169
Output	Billions of Fixed (2008) Dollars	0.072	0.111	0.115	0.094	-0.028	-0.033	-0.079	-0.092	-0.097	-0.089	-0.091	0.010
Population	Thousands	0.357	0.596	0.806	0.941	0.710	0.427	0.081	-0.208	-0.443	-0.619	-0.746	N/A
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	0.026	0.043	0.042	0.034	-0.020	-0.038	-0.058	-0.069	-0.076	-0.079	-0.081	-0.149
PCE-Price Index	2000=100 (Nation)	0.003	0.005	0.020	0.031	0.084	0.114	0.137	0.159	0.181	0.206	0.222	N/A

Levels

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Employment	Thousands (Jobs)	1,086.4	1,094.8	1,108.3	1,122.0	1,134.9	1,146.8	1,157.6	1,168.1	1,176.5	1,191.5	1,201.9
Gross Domestic Product	Billions of Fixed (2008) Dollars	69.5	71.1	72.7	74.3	75.9	77.6	79.3	81.0	82.4	84.5	86.3
Output	Billions of Fixed (2008) Dollars	93.7	96.4	99.1	101.7	104.3	107.0	109.8	112.7	115.3	118.8	121.9
Population	Thousands	2,057.6	2,088.9	2,120.6	2,152.5	2,184.2	2,216.2	2,248.2	2,280.5	2,312.5	2,345.3	2,378.6
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	57.6	58.8	60.1	61.5	62.9	64.3	65.7	67.0	68.2	69.5	70.7
PCE-Price Index	2000=100 (Nation)	132.7	136.2	140.0	144.1	148.4	152.8	157.5	162.5	167.5	172.8	178.3

Percent Change

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Employment	Thousands (Jobs)	0.08%	0.12%	0.13%	0.11%	0.01%	-0.01%	-0.03%	-0.01%	0.01%	0.04%	0.06%
Gross Domestic Product	Billions of Fixed (2008) Dollars	0.08%	0.13%	0.13%	0.11%	0.01%	-0.01%	-0.05%	-0.05%	-0.05%	-0.04%	-0.02%
Output	Billions of Fixed (2008) Dollars	0.08%	0.12%	0.12%	0.09%	-0.03%	-0.03%	-0.07%	-0.08%	-0.08%	-0.08%	-0.08%
Population	Thousands	0.02%	0.03%	0.04%	0.04%	0.03%	0.02%	0.00%	-0.01%	-0.02%	-0.03%	-0.03%
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	0.05%	0.07%	0.07%	0.06%	-0.03%	-0.06%	-0.09%	-0.10%	-0.11%	-0.11%	-0.11%
PCE-Price Index	2000=100 (Nation)	0.00%	0.00%	0.01%	0.02%	0.06%	0.07%	0.09%	0.10%	0.11%	0.12%	0.13%

Cap 40+CP Case

Differences from Baseline

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	NPV 2010-2020
Total Employment	Thousands (Jobs)	0.823	1.311	1.638	1.463	-0.719	-1.433	-1.668	-1.472	-1.247	-0.957	-0.763	N/A
Gross Domestic Product	Billions of Fixed (2008) Dollars	0.057	0.088	0.113	0.100	-0.048	-0.108	-0.142	-0.155	-0.159	-0.151	-0.152	-0.295
Output	Billions of Fixed (2008) Dollars	0.072	0.110	0.155	0.131	-0.088	-0.176	-0.229	-0.255	-0.267	-0.267	-0.282	-0.628
Population	Thousands	0.354	0.592	0.850	1.022	0.535	-0.085	-0.741	-1.317	-1.824	-2.252	-2.637	N/A
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	0.026	0.043	0.048	0.039	-0.060	-0.094	-0.122	-0.137	-0.147	-0.154	-0.161	-0.444
PCE-Price Index	2000=100 (Nation)	0.003	0.005	0.026	0.040	0.137	0.154	0.183	0.202	0.227	0.250	0.276	N/A

Levels

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Employment	Thousands (Jobs)	1,086.4	1,094.8	1,108.5	1,122.2	1,134.1	1,145.5	1,156.3	1,166.8	1,175.1	1,190.1	1,200.4
Gross Domestic Product	Billions of Fixed (2008) Dollars	69.5	71.1	72.7	74.3	75.8	77.5	79.2	80.8	82.3	84.4	86.2
Output	Billions of Fixed (2008) Dollars	93.7	96.4	99.1	101.7	104.2	106.9	109.7	112.5	115.1	118.6	121.7
Population	Thousands	2,057.6	2,088.9	2,120.7	2,152.5	2,184.1	2,215.7	2,247.4	2,279.4	2,311.1	2,343.7	2,376.7
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	57.6	58.8	60.2	61.5	62.9	64.3	65.7	66.9	68.1	69.5	70.6
PCE-Price Index	2000=100 (Nation)	132.7	136.2	140.0	144.1	148.4	152.9	157.5	162.5	167.6	172.9	178.3

Percent Change

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Employment	Thousands (Jobs)	0.08%	0.12%	0.15%	0.13%	-0.06%	-0.13%	-0.14%	-0.13%	-0.11%	-0.08%	-0.06%
Gross Domestic Product	Billions of Fixed (2008) Dollars	0.08%	0.12%	0.16%	0.13%	-0.06%	-0.14%	-0.18%	-0.19%	-0.19%	-0.18%	-0.18%
Output	Billions of Fixed (2008) Dollars	0.08%	0.11%	0.16%	0.13%	-0.08%	-0.17%	-0.21%	-0.23%	-0.23%	-0.23%	-0.23%
Population	Thousands	0.02%	0.03%	0.04%	0.05%	0.03%	0.00%	-0.03%	-0.06%	-0.08%	-0.10%	-0.11%
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	0.05%	0.07%	0.08%	0.06%	-0.10%	-0.15%	-0.19%	-0.20%	-0.22%	-0.22%	-0.23%
PCE-Price Index	2000=100 (Nation)	0.00%	0.00%	0.02%	0.03%	0.09%	0.10%	0.12%	0.13%	0.14%	0.15%	0.16%

Cap 50+CP-Half Case

Differences from Baseline

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	NPV 2010-2020
Total Employment	Thousands (Jobs)	0.491	0.720	0.886	0.627	-2.152	-3.088	-3.429	-3.421	-3.321	-3.115	-3.109	N/A
Gross Domestic Product	Billions of Fixed (2008) Dollars	0.037	0.052	0.071	0.053	-0.135	-0.213	-0.258	-0.289	-0.306	-0.310	-0.330	-1.038
Output	Billions of Fixed (2008) Dollars	0.048	0.066	0.102	0.076	-0.199	-0.311	-0.378	-0.430	-0.465	-0.478	-0.523	-1.591
Population	Thousands	0.232	0.360	0.500	0.538	-0.229	-1.145	-2.092	-2.974	-3.787	-4.517	-5.217	N/A
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	0.016	0.024	0.028	0.014	-0.112	-0.154	-0.189	-0.213	-0.229	-0.242	-0.258	-0.856
PCE-Price Index	2000=100 (Nation)	0.002	0.003	0.016	0.034	0.149	0.164	0.195	0.212	0.234	0.262	0.284	N/A

Levels

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Employment	Thousands (Jobs)	1,086.0	1,094.2	1,107.8	1,121.4	1,132.7	1,143.8	1,154.5	1,164.8	1,173.0	1,187.9	1,198.0
Gross Domestic Product	Billions of Fixed (2008) Dollars	69.5	71.1	72.7	74.3	75.8	77.4	79.1	80.7	82.2	84.3	86.0
Output	Billions of Fixed (2008) Dollars	93.7	96.4	99.0	101.7	104.1	106.8	109.5	112.3	114.9	118.4	121.5
Population	Thousands	2,057.5	2,088.7	2,120.3	2,152.1	2,183.3	2,214.7	2,246.1	2,277.8	2,309.2	2,341.4	2,374.1
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	57.6	58.8	60.1	61.5	62.8	64.2	65.6	66.9	68.0	69.4	70.5
PCE-Price Index	2000=100 (Nation)	132.7	136.2	140.0	144.1	148.4	152.9	157.5	162.5	167.6	172.9	178.4

Percent Change

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Employment	Thousands (Jobs)	0.05%	0.07%	0.08%	0.06%	-0.19%	-0.27%	-0.30%	-0.29%	-0.28%	-0.26%	-0.26%
Gross Domestic Product	Billions of Fixed (2008) Dollars	0.05%	0.07%	0.10%	0.07%	-0.18%	-0.27%	-0.33%	-0.36%	-0.37%	-0.37%	-0.38%
Output	Billions of Fixed (2008) Dollars	0.05%	0.07%	0.10%	0.07%	-0.19%	-0.29%	-0.34%	-0.38%	-0.40%	-0.40%	-0.43%
Population	Thousands	0.01%	0.02%	0.02%	0.03%	-0.01%	-0.05%	-0.09%	-0.13%	-0.16%	-0.19%	-0.22%
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	0.03%	0.04%	0.05%	0.02%	-0.18%	-0.24%	-0.29%	-0.32%	-0.34%	-0.35%	-0.36%
PCE-Price Index	2000=100 (Nation)	0.00%	0.00%	0.01%	0.02%	0.10%	0.11%	0.12%	0.13%	0.14%	0.15%	0.16%

Cap 5+CP-HighPrice Case

Differences from Baseline

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	NPV 2010-2020
Total Employment	Thousands (Jobs)	1.021	1.409	1.254	0.706	-0.001	-0.753	-1.436	-1.457	-1.224	-0.954	-0.721	N/A
Gross Domestic Product	Billions of Fixed (2008) Dollars	0.079	0.100	0.071	0.014	-0.050	-0.136	-0.220	-0.277	-0.302	-0.326	-0.363	-0.855
Output	Billions of Fixed (2008) Dollars	0.163	0.166	0.105	-0.025	-0.142	-0.317	-0.503	-0.641	-0.722	-0.815	-0.918	-2.267
Population	Thousands	0.399	0.651	0.808	0.804	0.600	0.227	-0.281	-0.762	-1.157	-1.470	-1.712	N/A
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	0.035	0.045	0.033	0.006	-0.028	-0.064	-0.100	-0.123	-0.132	-0.137	-0.141	-0.368
PCE-Price Index	2000=100 (Nation)	0.004	0.008	0.026	0.044	0.071	0.086	0.099	0.114	0.125	0.136	0.138	N/A

Levels

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Employment	Thousands (Jobs)	1,086.6	1,094.9	1,108.2	1,121.5	1,134.9	1,146.2	1,156.5	1,166.8	1,175.1	1,190.1	1,200.4
Gross Domestic Product	Billions of Fixed (2008) Dollars	69.5	71.1	72.7	74.2	75.8	77.5	79.1	80.7	82.2	84.2	86.0
Output	Billions of Fixed (2008) Dollars	93.8	96.5	99.0	101.6	104.2	106.8	109.4	112.1	114.7	118.0	121.1
Population	Thousands	2,057.7	2,089.0	2,120.6	2,152.3	2,184.1	2,216.0	2,247.9	2,280.0	2,311.8	2,344.4	2,377.6
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	57.6	58.8	60.1	61.4	62.9	64.3	65.7	67.0	68.1	69.5	70.7
PCE-Price Index	2000=100 (Nation)	132.7	136.2	140.0	144.1	148.4	152.8	157.5	162.4	167.5	172.8	178.2

Percent Change

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Employment	Thousands (Jobs)	0.09%	0.13%	0.11%	0.06%	0.00%	-0.07%	-0.12%	-0.13%	-0.10%	-0.08%	-0.06%
Gross Domestic Product	Billions of Fixed (2008) Dollars	0.11%	0.14%	0.10%	0.02%	-0.07%	-0.18%	-0.28%	-0.34%	-0.37%	-0.39%	-0.42%
Output	Billions of Fixed (2008) Dollars	0.17%	0.17%	0.11%	-0.03%	-0.14%	-0.30%	-0.46%	-0.57%	-0.63%	-0.69%	-0.75%
Population	Thousands	0.02%	0.03%	0.04%	0.04%	0.03%	0.01%	-0.01%	-0.03%	-0.05%	-0.06%	-0.07%
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	0.06%	0.08%	0.05%	0.01%	-0.05%	-0.10%	-0.15%	-0.18%	-0.19%	-0.20%	-0.20%
PCE-Price Index	2000=100 (Nation)	0.00%	0.01%	0.02%	0.03%	0.05%	0.06%	0.06%	0.07%	0.08%	0.08%	0.08%

Cap 20+CP-HighPrice Case

Differences from Baseline

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	NPV 2010-2020
Total Employment	Thousands (Jobs)	1.021	1.409	1.318	1.011	-0.510	-1.526	-2.234	-2.325	-2.303	-2.110	-2.047	N/A
Gross Domestic Product	Billions of Fixed (2008) Dollars	0.079	0.100	0.078	0.043	-0.079	-0.189	-0.281	-0.346	-0.394	-0.428	-0.481	-1.167
Output	Billions of Fixed (2008) Dollars	0.163	0.166	0.117	0.029	-0.175	-0.387	-0.583	-0.733	-0.853	-0.959	-1.087	-2.680
Population	Thousands	0.399	0.651	0.834	0.903	0.534	-0.046	-0.748	-1.421	-2.047	-2.578	-3.073	N/A
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	0.035	0.045	0.037	0.018	-0.053	-0.098	-0.140	-0.166	-0.185	-0.194	-0.209	-0.567
PCE-Price Index	2000=100 (Nation)	0.004	0.009	0.022	0.047	0.103	0.118	0.134	0.148	0.162	0.169	0.181	N/A

Levels

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Employment	Thousands (Jobs)	1,086.6	1,094.9	1,108.2	1,121.8	1,134.3	1,145.4	1,155.7	1,165.9	1,174.0	1,188.9	1,199.1
Gross Domestic Product	Billions of Fixed (2008) Dollars	69.5	71.1	72.7	74.3	75.8	77.4	79.1	80.7	82.1	84.1	85.9
Output	Billions of Fixed (2008) Dollars	93.8	96.5	99.1	101.6	104.1	106.7	109.3	112.0	114.6	117.9	120.9
Population	Thousands	2,057.7	2,089.0	2,120.6	2,152.4	2,184.1	2,215.8	2,247.4	2,279.3	2,310.9	2,343.3	2,376.3
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	57.6	58.8	60.1	61.5	62.9	64.3	65.7	66.9	68.1	69.4	70.6
PCE-Price Index	2000=100 (Nation)	132.7	136.2	140.0	144.1	148.4	152.8	157.5	162.5	167.5	172.8	178.3

Percent Change

Variable	Units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Employment	Thousands (Jobs)	0.09%	0.13%	0.12%	0.09%	-0.05%	-0.13%	-0.19%	-0.20%	-0.20%	-0.18%	-0.17%
Gross Domestic Product	Billions of Fixed (2008) Dollars	0.11%	0.14%	0.11%	0.06%	-0.11%	-0.24%	-0.36%	-0.43%	-0.48%	-0.51%	-0.56%
Output	Billions of Fixed (2008) Dollars	0.17%	0.17%	0.12%	0.03%	-0.17%	-0.36%	-0.53%	-0.65%	-0.74%	-0.81%	-0.89%
Population	Thousands	0.02%	0.03%	0.04%	0.04%	0.02%	0.00%	-0.03%	-0.06%	-0.09%	-0.11%	-0.13%
Real Disposable Personal Income	Billions of Fixed (2008) Dollars	0.06%	0.08%	0.06%	0.03%	-0.08%	-0.15%	-0.21%	-0.25%	-0.27%	-0.28%	-0.30%
PCE-Price Index	2000=100 (Nation)	0.00%	0.01%	0.02%	0.03%	0.07%	0.08%	0.09%	0.09%	0.10%	0.10%	0.10%