NEW MEXICO CLIMATE CHANGE ADVISORY GROUP

FINAL REPORT
December 2006

Executive Summary

Recognizing the profound implications that global warming and climate variation could have on the economy, environment and quality of life in the Southwest, New Mexico Governor Bill Richardson signed Executive Order 05-33 on June 5th, 2005, establishing the New Mexico Climate Change Advisory Group (CCAG).[1] The Governor directed the CCAG to prepare a report that includes a projection of the State's future GHG emissions and policy recommendations for reducing New Mexico's total greenhouse gas emissions to 2000 levels by the year 2012, 10% below 2000 levels by 2020 and 75% by 2050.

The New Mexico Environment Department (NMED) organized the process on behalf of the Governor. NMED assembled 37 stakeholders, representing a broad range of interests and expertise, and the CCAG met six times from July 2005 to October 2006. During this same period, five sector-based technical work groups (TWGs) of the CCAG developed initial recommendations in the areas of: Energy Supply (ES); Residential, Commercial, Industrial and Waste Management (RCI); Transportation and Land Use (TLU); Agriculture and Forestry (AF); and Cross-Cutting Issues (CC). With oversight from NMED, the CCAG followed a consensus-building process designed and implemented by the non-profit Center for Climate Strategies (CCS). Applying a design similar to those used in other successful state climate initiatives, CCS provided both facilitation services and technical analysis to the CCAG in formulating its recommendations.

CCAG Policy Recommendations and Impacts

The CCAG offers 69 policy recommendations to the Governor to help meet the GHG emissions goals in Executive Order 05-33. Figure EX-1 below presents:

- Projected growth in New Mexico's GHG emissions[2] (blue line).
- Emission targets in the Executive Order (red line).
- Projected emissions if the CCAG's recommendations are fully implemented (green line).

As the figure illustrates, the CCAG's recommendations would more than meet the Governor's targets, and are projected to reduce GHG emissions by approximately half, from 70 MMTCO2e in the reference case forecast to 34 MMTCO2e by 2020. Table EX-1 (appearing below Figure EX-1) provides the numeric estimates underlying Figure EX-1.

[1] Appendix A contains the Executive Order.
[2] The "reference case" projection of emissions was developed during the CCAG process, along with the inventory of historical emissions since 1990, as set forth in detail in Chapter 2.

Figure EX-1

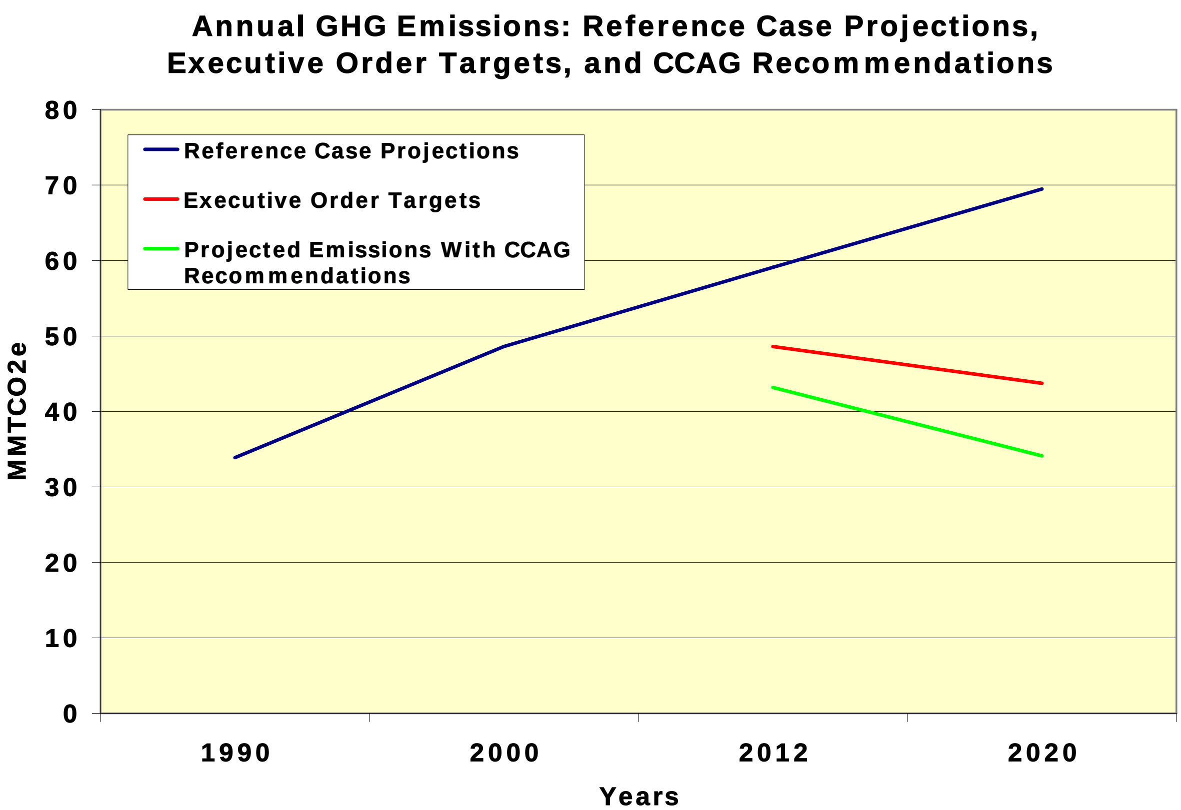


Table EX-1. Annual Emissions: Reference Case Projections, Executive Order Targets, and Impact of CCAG Recommendations

ANNUAL EMISSIONS	1990	2000	2012	2020
REFERENCE CASE PROJECTIONS	33.9	48.6	59.1	69.5
EXECUTIVE ORDER TARGETS [a]			48.6	43.7
GHG REDUCTIONS FROM CCAG RECOMMENDATIONS			*-15.9*	*-35.4*
ANNUAL EMISSIONS WITH CCAG RECOMMENDATIONS			43.2	34.1

[a] Targets aim to reduce New Mexico GHG emissions to 2000 levels by 2012, and 10% below 2000 levels by 2020.

Table EX-2 summarizes the emissions and economic impacts of CCAG recommendations across sectors of the economy.

Table EX-2. Summary by Sector of Estimated Impacts of CCAG Recommendations

	Sector	GHG Reductions ($MMtCO_2e$)			Net Present Value 2007–2020 (Million $)	Cost-Effective-ness ($\$/tCO_2e$)
		2012	2020	Total 2007-2020		
	CROSS-CUTTING ISSUES	*Non-quantified enabling policies*				
	RESIDENTIAL, COMMERCIAL AND INDUSTRIAL	3.7	9.4	66.0	-630	-18
	ENERGY SUPPLY	6.7	14.3	109.9	258	7
	TRANSPORTATION AND LAND USE	3.1	6.8	50.5	-1,669	-36
	AGRICULTURE AND FORESTRY	2.5	4.9	41.1	-198	-5
	TOTAL (includes all adjustments for overlaps and recent policy actions)	15.9	35.4	267.5	-$2,239	

The CCAG's recommendations are summarized below in Table EX-3, followed by short descriptions of each recommendation. Detailed descriptions and analysis of these recommendations are presented in Chapters 3 through 7 of this report, and in the Appendices. Cumulative GHG reductions from 2007-2020 are estimated at 267 MMTCO2e. The recommendations are projected to create net economic savings of over $2 billion for the State's economy over the period 2007-2020.[3]

As discussed in Chapter 1, the Governor's goals are consistent with the levels and framework of goals set by other states, including those in the West, that are implementing GHG reduction strategies. The CCAG's recommendations also complement other efforts underway in New Mexico, especially the Governor's many initiatives to make it the "Clean Energy State." This report also points to numerous co-benefits that would result from implementation of CCAG-recommended policies.

[3] This estimate is calculated on a net present value basis using a discount rate of 5%. It does not account for recommendations for which cost estimates were not available.

Table EX-3

Summary of CCAG Policy Recommendations by Sector

Explanatory Note on "Level of Support" column: UC=Unanimous Consent. Majority=Simple majority. Obj's=number of objections. Total number of options=69 due to counting both ES-1b and ES-1c.

	Policy Option	GHG Reductions ($MMtCO_2e$)			Net Present Value 2007–2020 (Million $)	Cost-Effective-ness ($\$/tCO_2e$)	Level of Support
		2012	2020	Total 2007-2020			
	CROSS-CUTTING ISSUES						
CC-1	State Greenhouse Gas Reporting	*Non-quantified enabling policy*					UC
CC-2	State Greenhouse Gas Registry	*Non-quantified enabling policy*					UC
CC-3	State Climate Public Education and Outreach	*Non-quantified enabling policy*					UC
	RESIDENTIAL, COMMERCIAL AND INDUSTRIAL						
RCI-1	Demand Side Management (DSM) Programs, Energy Efficiency Funds,and/or Energy Efficiency Requirements for Electricity	0.2	1.0	5.5	-$98	-$18	UC
RCI-2	Demand Side Management (DSM) Programs, Energy Efficiency Funds, and/or Energy Efficiency Requirements for Natural Gas and Other Fuels	0.03	0.2	1.0	-$55	-$55	UC
RCI-3	Regional Market Transformation Alliance	0.1	0.5	2.9	-$79	-$27	UC
RCI-4	State Appliance Standards	0.1	0.3	2.1	-$97	-$46	UC
RCI-5	Green Power Purchasing	0.3	0.1	2.3	$15	$7	UC
RCI-6	Rate Design (Including Time of Use Rates, Increasing Block Rates, and Seasonal Use Rates)	0.3	0.3	3.6	-$141	-$40	UC
RCI-7A	Improved Building Codes	0.9	2.4	16.6	-$200	-$12	UC
RCI-7B	Solar Hot Water-ready and Solar-PV-ready Codes for New Buildings	*Not quantified*					UC
RCI-7C	Solar Hot Water Systems as an Element of Building Codes for New Buildings	*Not quantified*					UC
RCI-8A	Building Energy Performance Requirements for State-funded and Other Government Buildings ("Reach Codes")	0.01	0.04	0.2	0.2	$1	UC
RCI-8B	Building Energy Performance Promotion and Incentives for Energy Performance Enhancements (Attaining "Reach Codes") in Non-Government Buildings (Including Existing Buildings)	0.3	1.3	7.4	-$16	-$2	UC
RCI-9	Government Agency Requirements and Goals (including procurement) -- Focus on operations	0.04	0.2	0.9	-$18	-$20	UC

	Policy Option	GHG Reductions ($MMtCO_2e$)			Net Present Value 2007–2020 (Million $)	Cost-Effective-ness ($/$tCO_2e$)	Level of Support
		2012	2020	Total 2007-2020			
RCI-10	**Education and Outreach for Building Professionals**	*Not quantified*					**UC**
RCI-11	**Consumer Education Programs**	*Not quantified Jointly considered with CC TWG*					**UC**
RCI-12	**Increased Emphasis on Energy and Environmental Consideration in Higher Education**						**UC**
RCI-13	**Incentives and Promotion for Renewable Energy and Clean Combined Heat and Power**	*Jointly considered with Energy Supply TWG*					**UC**
RCI-14	**Regulatory/Legislative Grid, Pricing, and other Policies to Support Distributed Generation**						**UC**
RCI-16	**Participation in Regional (or National) Industry Emissions Cap and Trade Programs**	*Jointly considered with Energy Supply TWG*					**UC**
RCI-17	**Voluntary Emissions Targets**	**0.3**	**0.7**	**4.6**	*Not quantified*		**UC**
RCI-18	**Use of Alternative Gases (Non-Energy Emissions, Indus. Process Gases)**	*Not quantified*					**UC**
RCI-19	**Solid Waste Recycling, Source Reduction, and Composting**						**UC**
	Scenario A: Financial/Technical Support	**0.2**	**0.5**	**3.6**	*Not quantified*		**UC**
	Scenario B: Financial/Technical Support and Mandatory Recycling	**0.5**	**1.1**	**8.4**	*Not quantified*		**UC**
	ENERGY SUPPLY						
ES-1	**Mandate(s) for Renewable Energy (RPS, etc.)**						
	Scenario B: 10% in 2011, 1% increase/year to 2021	**1.1**	**2.6**	**17.8**	**$102**	**$6**	**UC**
	Scenario C: 10% in 2011, 2% increase/year to 2021	*See ES-4 below*					**Majority (9 Obj's)**
ES-2	**Financial Incentives for Distributed Renewables**	**0.02**	**0.4**	**1.6**	**$164**	**$105**	**UC**
ES-3	**Renewable Energy Transmission and Storage**	*Not quantified*					**UC**
ES-4	**RPS with Financial Incentives for Centralized Renewables**	**1.2**	**4.2**	**26.0**	**$215**	**$8**	**UC**
ES-5	**R&D including Energy Storage**	*Not quantified*					**UC**
ES-6	**Advanced Coal/Fossil Technologies (e.g., IGCC with carbon capture)**	**0.8**	**4.3**	**22.7**	**$650**	**$29**	**UC**
ES-7	**Nuclear Power**	*Not quantified*					**UC**
ES-8	**Incentives and Barrier Reductions for Combined Heat & Power (CHP)**	**0.3**	**0.9**	**6.1**	**$26**	**$4**	**UC**

	Policy Option	GHG Reductions ($MMtCO_2e$) 2012	2020	Total 2007-2020	Net Present Value 2007–2020 (Million $)	Cost-Effective-ness ($/tCO₂e)	Level of Support
ES-9	Demand-Side Management, Energy Efficiency, and Integrated Resource Planning (IRP)	*Jointly considered with RCI TWG (RCI-1)*					
ES-10	Transmission Capacity and Corridors	*Not quantified*					UC
ES-11	CO2 Capture and Storage or Reuse (CCSR) in Oil and Gas Operations	1.6	3.0	25.1	*Not quantified*		UC
ES-12	Methane Reduction in Oil and Gas Operations: BMPs and PROs	2.7	3.4	35.3	*Not quantified*		UC
ES-13	CO2 Reduction from Fuel Combustion in Oil and Gas Operations	0.6	1.4	10.6	*Not quantified*		UC
ES-14	GHG Cap and Trade	*Not quantified*					UC
ES-15	Generation Performance Standard	1.2	3.8	24.3	$522	$21	Majority (9 Obj's)
ES-16	Clean Energy Development for Electric Cooperatives	*Non-quantified enabling policy*					UC
	TRANSPORTATION AND LAND USE						
TLU-1	State Clean Car Program	0.4	1.9	10.4	$1,207	-$117	UC
TLU-2	Low Rolling Resistance Tires	0.5	0.6	5.5	$506	-$92	UC
TLU-3	Low-GHG Operation of State Fleet Vehicles	*Not quantified*					UC
TLU-4	Pay-As-You-Drive Insurance	0.2	1.0	5.0	Zero net cost		UC
TLU-5	Incentive/Disincentive Options Bundle	*Not quantified*					UC
TLU-6	Alternative Fuels Use	0.4	1.7	9.1	-$119	-$13	UC
VMT Reduction Bundle TLU-7 to TLU-11							
TLU-7	Infill, Brownfield Re-development	1.2	1.3	13.4	*Zero net costs or positive cost savings*		UC
TLU-8	Transit-Oriented Development						UC
TLU-9	Smart Growth Planning, Modeling, Tools						UC
TLU-10	Multimodal Transportation Bundle						UC
TLU-11	Promote LEED for Neighborhood Development						UC
TLU-12	Targeted Open Space and Croplands Protection	*Considered in Agriculture and Forestry TWG (F-1 and A-8)*					
TLU-13	Diesel Retrofits	*Incorporated as part of TLU-5*					
TLU-14	Truck Stop Electrification/Anti-Idling	0.4	0.7	6.3	$23	$4	UC

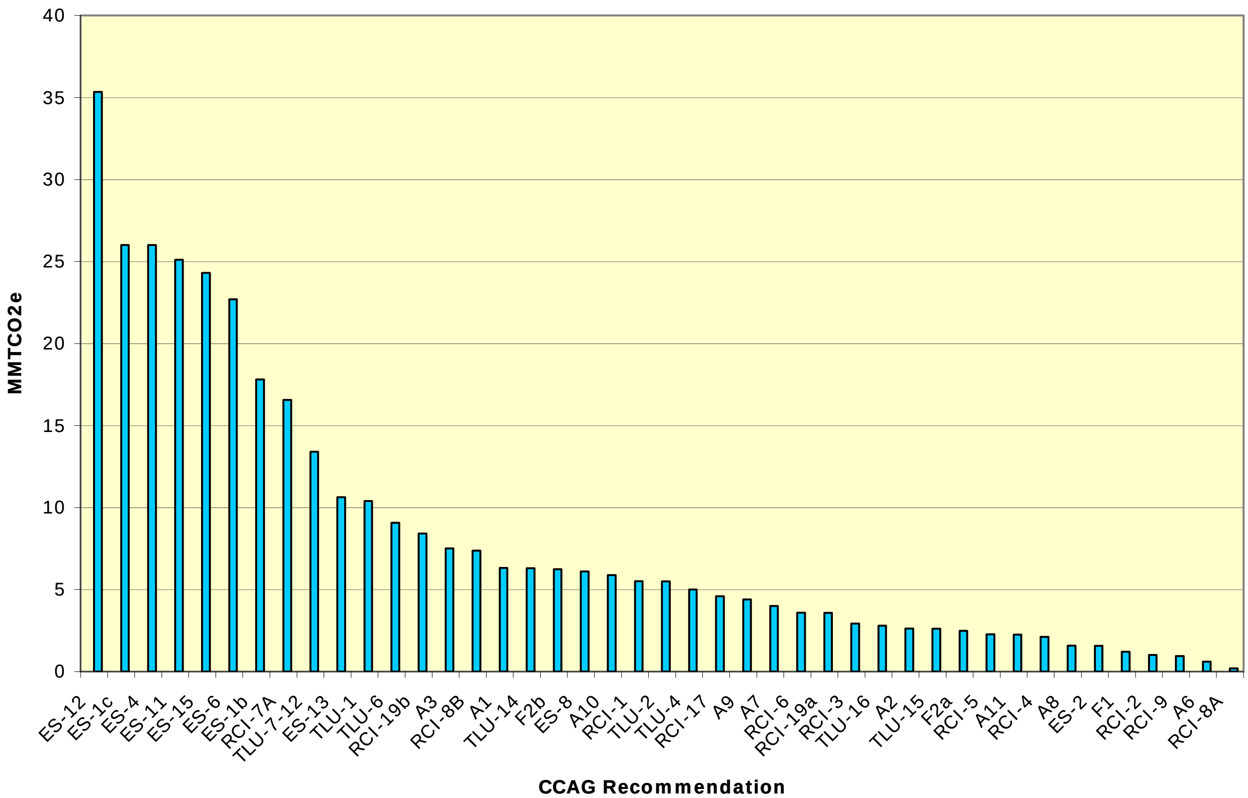
	Policy Option	GHG Reductions ($MMtCO_2e$)			Net Present Value 2007–2020 (Million $)	Cost-Effective-ness ($/$tCO_2e$)	Level of Support
		2012	2020	Total 2007-2020			
TLU-15	Intermodal Freight Initiatives	0.1	0.5	2.6	*Not quantified*		UC
TLU-16	Lower Speed Limits	0.2	0.3	2.8	*Not quantified*		UC
	AGRICULTURE AND FORESTRY						
F-1	Forestland Protection from Developed Uses	0.1	0.1	1.2	$46	$22	UC
F-2a	Forest Health & Restoration - Residential Lands	0.2	0.2	2.5	-$115	-$46	UC
F-2b	Forest Health & Restoration – Other Lands	0.5	0.5	6.3	-$92	-$15	UC
A-1	Manure Energy Utilization	0.3	0.8	6.3	$29	$3	UC
A-2	Biomass Feedstocks for Electricity or Steam Production	0.2	0.3	2.6	-$198	-$76	UC
A-3	Ethanol Production	0.5	1.0	7.5	$20	$3	UC
A-6	Conservation Tillage/No-Till	0.1	0.1	0.6	$14	$15	UC
A-7	Convert Agricultural Land to Grassland or Forest	0.4	0.4	4.0	$27	$7	UC
A-8	Reduce Permanent Conversion of Agricultural Land and Rangeland to Developed Uses	0.1	0.2	1.6	$97	$62	UC
A-9	Programs to Support Organic Farming	0.2	0.4	4.4	$2	$0.5	UC
A-10	Programs to Support Local Farming/Buy Local	0.3	1.1	5.9	$1	$0.2	UC
A-11	Biodiesel Production	0.1	0.3	2.3	*Not quantified*		UC
	TOTAL AFTER ADJUSTING FOR OVERLAPS AND RECENT POLICY ACTIONS	16	35	267	-$2,239		n/a

Perspectives on Policy Recommendations

There is a large variation in the GHG reductions associated with various options. Figure EX-2 presents the estimated tons of reductions for each policy recommendation for which estimates were available, expressed as a cumulative figure for the period 2007-2020.

Figure EX-2

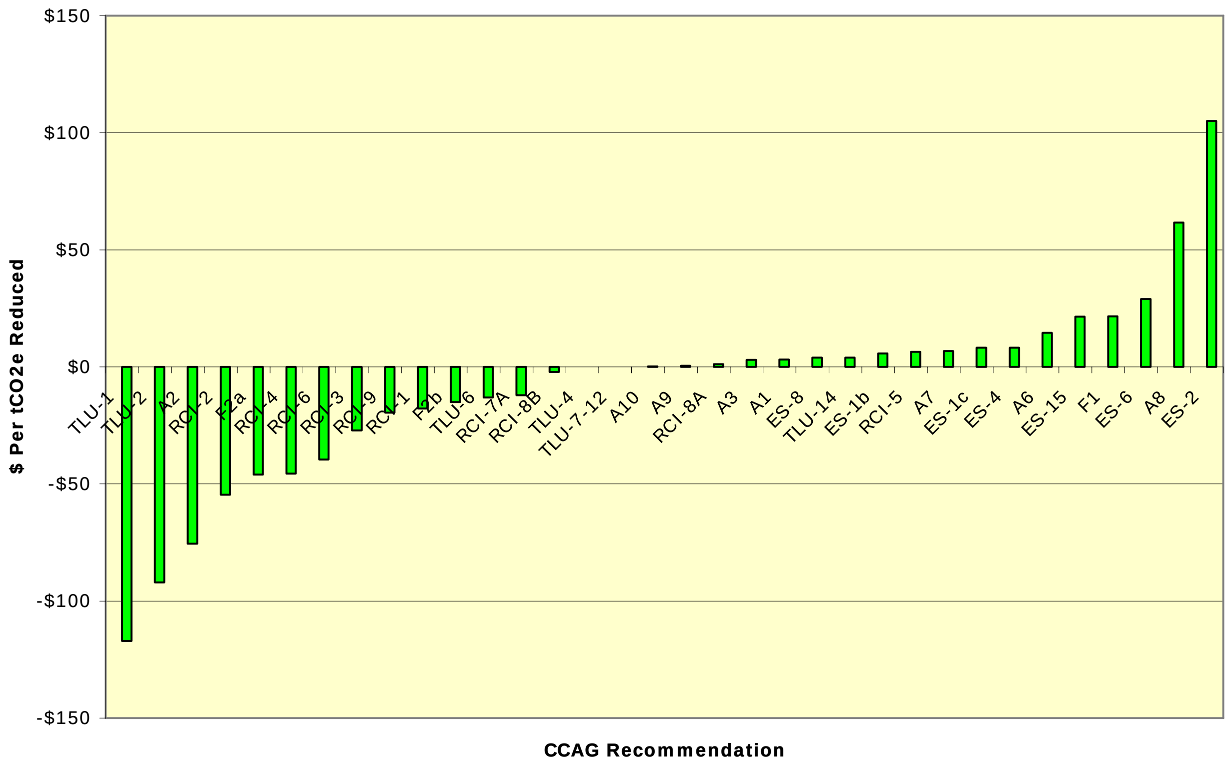
CCAG Policy Recommendations Ranked by Cumulative GHG Reductions, 2007-2020



There is also variation in the cost (or cost savings) per ton of reduction associated with various options. Figure EX-3 presents the estimated dollars per ton cost (or cost savings, depicted as a negative number) for each policy recommendation for which cost estimates were available. This measure is calculated by dividing the net present value of the cost of the option by the cumulative GHG reductions, all for the period 2007-2020.

Figure EX-3

CCAG Policy Recommendations Ranked by Dollars per Ton



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Acknowledgments

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Glossary

AEO2005 – US DOE Energy Information Administration's Annual Energy Outlook 2005
BCF – Billion cubic feet
BLM – Bureau of Land Management
BRT – Bus Rapid Transit
CAC – Central Air Conditioning
CBM – Coal-bed Methane
CC – Cross-Cutting Issues
CCAG – Climate Change Advisory Group
CCSR – Carbon Capture and Sequestration or Reuse
CH4 – Methane
CHP – Combined Heat and Power
CO_2 – Carbon Dioxide
CO_2e – Carbon Dioxide equivalent
CRP – Conservation Reserve Program
DSM – Demand Side Management
EIA – US DOE Energy Information Administration
EMNRD - Energy, Minerals and Natural Resources Department
FIA – Forest Inventory Analysis (US Forest Service)
FHWA – Federal Highway Administration
GHG – Greenhouse Gases
GNP – Gross National Product
GSP – Gross State Product
GPS – generation performance standard
GWP – Global Warming Potential
GWh – Gigawatt-hours (1 million kilowatt-hours)
HFCs – Hydrofluorocarbons
IGCC – Integrated Gasification Combined Cycle
IOU – Investor-Owned Utility
IPCC – Intergovernmental Panel on Climate Change
KWh – Kilowatt-hour
LSE – Load Serving Entity
Mt – Metric ton (equivalent to 1.102 short tons)
MMt – Million Metric tons
$MMtCO_2e$ – Million Metric tons of carbon dioxide equivalent
MTBE – Methyl Tertiary Butyl Ether
MWh – Megawatt-hours (1 thousand kilowatt-hours)
N2O – Nitrous Oxide
NEMS – National Energy Modeling System
NERC – North American Electric Reliability Council
NMED – New Mexico Environment Department
NMDOT – New Mexico Department of Transportation

NMOCD – Oil Conservation Division (of New Mexico Energy, Minerals, and Natural Resources Department)
NMOGA – New Mexico Oil and Gas Association
NPA – Net Present Value
NREL – National Renewable Energy Laboratory
O&M – Operations and Maintenance
ODS – Ozone-Depleting Substances
PAYD – Pay As You Drive
PFCs – Perfluorocarbons
PNM – Public Service of New Mexico
PRC – Public Regulatory Commission
PV – Photovoltaic
RCI – Residential, Commercial, and Industrial
REC – Renewable Energy Certificate
RPS – Renewable Portfolio Standard
SEDS – US DOE Energy Information Administration's State Energy Data System
SGIT – US EPA State Greenhouse gas Inventory Tool
SF6 – Sulfur Hexafluoride
Sinks – Removals of carbon from the atmosphere, with the carbon stored in forests, soils, landfills, wood structures, or other biomass-related products.
TLU – Transportation and Land Use
TOD – Transit Oriented Development
TWG – Technical Work Group
TWh – Terawatt-hours (1 billion kilowatt-hours)
US EPA – US Environmental Protection Agency
US DOE – US Department of Energy
VMT – Vehicle-Miles Traveled
WECC – Western Electric Coordinating Council
WGA – Western Governors Association
WRAP – Western Regional Air Partnership
WUI – Wildlife-Urban Interface

Chapter 1
Background and Overview

The Governor's Executive Order

Recognizing the profound implications that global warming and climate variation could have on the economy, environment and quality of life in the Southwest, New Mexico Governor Bill Richardson signed Executive Order 05-033 on June 5th, 2005, establishing the New Mexico Climate Change Advisory Group (CCAG).[1] The Governor directed the CCAG to prepare a report that includes:

- Proposals for reduction of New Mexico's total greenhouse gas (GHG) emissions to 2000 levels by the year 2012, 10% below 2000 levels by 2020, and 75% by 2050.
- An inventory of existing and planned actions that contribute to GHG emissions reductions.
- Consideration of costs and benefits of proposals.
- An inventory of historical and forecasted GHG emissions in New Mexico.
- Findings on initiatives to create meaningful regional and national policy to address climate change.

This report is the outcome of that effort, one that involved a distinguished and broad group of stakeholders, the New Mexico Environment Department and other state agencies, and the Center for Climate Strategies.

The Governor's Executive Order noted the scientific consensus on this issue as embodied by reports issued by the Intergovernmental Panel on Climate Change (IPCC) and the National Academy of Sciences. Climate models indicate that global average temperatures could rise from 3 to 10 degrees by the end of this century. The IPCC predicts that such a warming will result in rising sea levels, increased rainfall rates and heavy precipitation events (especially over the higher latitudes) and higher evaporation rates that would accelerate the drying of soils following rain events. With higher sea levels, coastal regions could face increased wind and flood damage, and some models predict an increase the intensity of tropical storms. Executive Order 05-033 also directed State agencies to prepare a study on the potential effects of such warming on New Mexico. That study, issued in December 2005, cites the potential for prolonged drought, increased snowmelt, reduced snow pack, severe forest fires, and other harmful effects. [2]

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[1] Appendix A contains the Executive Order.
[2] Agency Technical Work Group, State of New Mexico, Potential Effects of Climate Change on New Mexico, December 30, 2005. www.nmenv.state.nm.us/cc/Potential_Effects_Climate_Change_NM.pdf.

Recent Policy Developments

In 2004, Governor Richardson declared New Mexico "The Clean Energy State". The state has completed implementation of many programs and initiatives to promote clean energy and reduce greenhouse gas emissions under the Governor's leadership. Examples include:

- New Mexico was the first state in the country to initiate state government membership in the Chicago Climate Exchange. The Exchange requires members to reduce greenhouse gas emissions annually or buy credits from those that reduce more than required.
- New Mexico has inventoried state government's emissions of greenhouse gases and is working on programs to promote reduction of greenhouse gas emissions throughout state government operations.
- The Governor issued an executive order that requires all state agency buildings that are newly constructed or renovated to adopt the LEED system.
- Under Governor Richardson's executive order, by 2010, 15% of state agency fuels purchased must be from renewable fuels, such as ethanol or biodiesel; and 75% of state agency vehicles acquired each year must be capable of operating on alternative fuels or be gas-electric hybrids.
- The State's renewable portfolio standard requires 10% renewable energy by 2011 and utilities are required to offer a green power tariff to allow ratepayers to opt to pay a premium for renewable energy.
- Recent legislation to promote renewable energy development includes solar energy tax rebates on installation of solar energy systems, an energy production tax credit to provide incentive for renewable energy development, and net metering allowance.
- The Governor has established a Clean Energy Development Council to develop policy recommendations to grow clean energy in New Mexico. The Council has several subcommittees devoted to various sectors of renewable energy and energy efficiency, like wind, solar, and biomass power, as well as green buildings.

On October 31, 2006, Governor Richardson announced his plans for future clean energy development and greenhouse gas emissions reductions in the state (many of which are consistent with CCAG recommendations).[3] He proposed:

- Increased funding for public school facilities to help build green public schools across the state, increasing energy efficiency.
- A tax credit to promote green offices and homes.
- A tax cut for consumers purchasing certified energy-efficient large appliances and central heating and cooling systems.
- Tax credits for the use and distribution of biofuels, and a requirement to increase use of biofuels to 20% of transportation fuel by 2020.
- Adoption of the State Clean Car Program which will dramatically reduce the greenhouse gas emissions of new cars and trucks sold in New Mexico by approximately 22% by 2012 and 30% by 2016.

[3] http://www.governor.state.nm.us/press.php?id=305

- An increase in the state's renewable portfolio standard to 15% by 2015 and 25% by 2020.
- Tax credits for renewable energy factories.
- An Energy Innovation Fund to develop new technologies for clean energy.

Governor Richardson is also committed to action at the regional level. He partnered with Governor Napolitano of Arizona to commit both states to working together towards greenhouse gas emissions reductions through western and national initiatives, such as regional inventories and registries. New Mexico is participating with thirty other states in developing a policy-neutral registry tool that will enable regional and/or national cap and trade programs in the future. The Governor also joined with Governor Schwarzenegger of California in committing the Western Governor's Association to goals of 30,000 megawatts of clean energy produced in the west by 2015 and a 20% increase in energy efficiency by 2020. .

The CCAG Process

The CCAG held its first meeting on July 27, 2005, followed by over a year of intensive fact-finding and consensus building. The CCAG met six times, with its last formal meeting on October 30, 2006. During this period five sector-based technical work groups (TWGs) of the CCAG met over 60 times via teleconference, beginning in August 2005 and concluding in October 2006.

The TWGs consisted of CCAG members as well as individuals not on the CCAG with interest and expertise in the issues being addressed by each TWG. The five TWGs were: Energy Supply (ES); Residential, Commercial, Industrial and Waste Management (RCI); Transportation and Land Use (TLU); Agriculture and Forestry (AF); and Cross-Cutting Issues (CC).

The CCAG process involved a model of informed self-determination through a facilitated stepwise consensus building approach. Under the oversight of NMED, the process was conducted by the Center for Climate Strategies (CCS), an independent, expert facilitation and technical analysis team, based on procedures that CCS consultants have used in a number of other state climate change planning initiatives since 2000, adapted specifically for New Mexico.

During the course of the process, the CCAG evaluated an inventory and projection of future GHG emissions, specific mitigation options, and findings related to benefits, costs, and feasibility issues associated with options. The CCAG process sought, but did not mandate consensus, and it explicitly documented the level of CCAG support for individual policy recommendations and key findings established through a voting process, including barriers to consensus where they existed.

The recommendations adopted by the CCAG and presented in this report underwent two levels of screening by the CCAG. First, a potential policy option being considered by a TWG was not accepted as a "priority for analysis" and developed for full analysis unless it had a supermajority of support from CCAG members (with a "supermajority" defined as five or fewer "no" votes or objections). Second, after the analyses were conducted, only policy options that received at least majority support from CCAG members were adopted as recommendations by the CCAG and included in this report. In total, of the 69 policy recommendations adopted by the CCAG, 67 received unanimous consent, and 2 received a majority of support (see later chapters in this report and the appendices for details).

Analysis of Options

With CCS providing facilitation and technical analysis, the TWGs prepared policy options for CCAG consideration using a "policy template" conveying key information:

- Policy description
- Policy design (goals, timing, parties involved)
- Implementation mechanisms
- Related policies / programs in place
- Estimated GHG reductions and costs
- Key uncertainties
- Contributing issues
- Feasibility issues
- Status of group approval
- Level of group support
- Barriers to consensus

In its deliberations, the CCAG modified and embraced various policy options. The final versions, conforming to the original policy templates, appear in Appendices F through J and constitute the most detailed record of decision of the CCAG. Appendix E presents a description of the methods used for quantification of policy options. Three key methods are summarized here:

- *Estimates of GHG reductions.* Using the projection of future GHG emissions (see below) as a starting point, analysis of the impact of policy options produced estimates of the GHG reductions attributable to each option in the years 2012 and 2020, and cumulative over the time period 2007-2020. Many options were estimated to affect the quantity or type of fossil fuel combusted; others affected methane or CO2 sequestered, etc. Among the many assumptions involved in this task was selection of the appropriate GHG accounting framework, namely, the choice between taking a "production-based" approach vs. a "consumption-based" approach to various sectors of the economy.[4] The CCAG took a "production-based" approach in all sectors except the electricity sector, in both forecasting emissions and in estimating the GHG impacts of policy options. This issue, along with other GHG estimation issues (e.g., analysis of overlapping or interacting policy impacts), are discussed in detail in Chapter 2, Appendix D, and Appendix E. In addition, the application of the consumption–based approach for the electricity sector receives additional treatment in Chapter 5 and Appendix H.
- *Estimates of cost.* CCS and the TWGs produced estimates of the cost of various policy options, both in terms of a net present value from 2007-2020 and a dollars-per-ton cost (i.e.,

[4] In brief, a production-based approach estimates GHG emissions associated with goods and services produced within the state, and a consumption-based approach estimates GHG emissions associated with goods and services consumed within the state. In some sectors of the economy, these two approaches may not result in significantly different numbers, however, the power sector is notable in that it is responsible for large quantities of GHG emissions, and states often produce far more or far less electricity than they consume (with the remainder attributable to power exports or imports).

cost-effectiveness).[5] The costing approach used was similar to a conventional cost-benefit framework but had some important differences:

- *Benefits vs costs.* The principal benefit of the CCAG options is reduced GHG emissions and these were quantified simply as tons. There was no attempt to monetize the benefit of these reductions. Many options did create easily monetized non-GHG benefits, e.g., fuel savings and electricity savings. In these cases, monetized benefits were subtracted from monetized costs, resulted in net costs. These net costs could be positive or negative; negative costs indicated that the option saved money or produced "cost savings."
- *Direct vs. Indirect Effects.* Cost estimates were based on "direct effects", i.e., those borne by the entities implementing the option.[6] Implementing entities could be: individuals, companies, and/or government agencies, etc. In contrast, conventional cost-benefit analysis takes the "societal perspective" and tallies every conceivable impact on every entity in society (and quantifies these wherever possible).
- *New Mexico vs. National/Global perspective.* Costs estimates were based on implementing entities in New Mexico, not on a broader societal perspective (national or global). One implication of this is that national taxes or subsidies that affect actions in New Mexico were not part of the analysis.
- *Discounted and "Levelized" Costs.* Fairly standard approaches were taken here. The "present value" of costs were calculated by applying a real discount rate of 5%. Dollars-per-ton estimates were derived as a "levelized" cost per ton, dividing the "present value cost" by the cumulative GHG reduction measured in tons. As was the case with GHG reductions, the period 2007-2020 was analyzed.

- *Contributing issues.* The CCAG recommendations were guided in part by the GHG reductions and monetized costs and benefits of various options, but members also felt that other considerations should have weight as well. The CCAG developed a checklist for TWGs to use to keep in mind important human, social, economic, environmental, and other factors that may warrant consideration when evaluating GHG emission reduction strategies. The TWGs were asked to examine these qualitative terms where deemed important, and quantify them on a case by case as needed depending on need and where data was readily available.

New Mexico GHG Emissions Inventory and Reference Case Projections

Pursuant to the Governor's Executive Order and in cooperation with NMED, CCS prepared a draft document, entitled *New Mexico GHG Emissions Inventory and Reference Case Projections, 1990-2020* (hereafter *Inventory and Projections*). The projection of future emissions aimed to capture as accurately as possible the trajectory of emissions given policies in place as of 2005. The draft was presented to the CCAG at its first meeting, and then approved by unanimous consent at the CCAG's 3rd meeting following technical review and revision.[7] The *Inventory and*

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[5] The analysis addressed cost and did not attempt to estimate specific price changes or utility rate changes that might result from implementation of a policy option.
[6] "Indirect effects" were defined as those borne by entities other than those implementing the option. These indirect effects were quantified on a case-by-case basis depending on magnitude, importance, need and availability of data.
[7] With final technical corrections performed for this final CCAG report.

Projections included detailed coverage of all economic sectors and GHGs in New Mexico, including future emissions trends and assessment issues related to energy, economic and population growth. The assessment provided four discrete perspectives on total State emissions related to:

- The distinction between "gross emissions" (leaving aside sequestration) or "net emissions" (in which reductions due to sequestration are subtracted from gross emissions).
- How the "production-based" vs. "consumption-based" accounting issue was handled (see earlier discussion).

These two key factors resulted in the following perspectives:

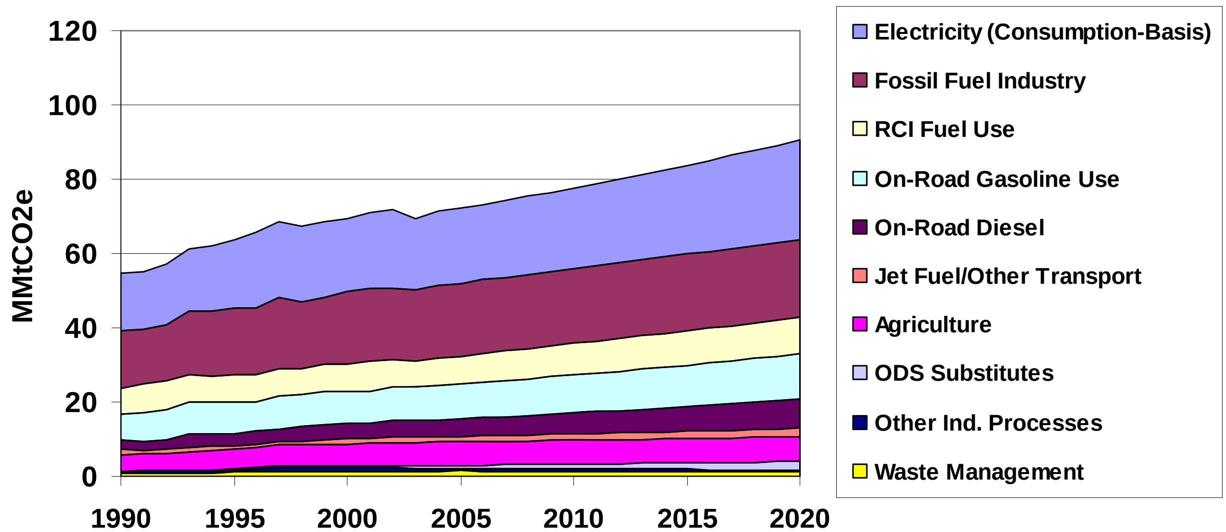
1. Gross GHG emissions using the production-based approach in all sectors
2. Net GHG emissions using the production-based approach in all sectors
3. Gross GHG emissions using the consumption-based approach in the electricity sector
4. Net GHG emissions using the consumption-based approach in the electricity sector

After considering the relative merits of these perspectives, the CCAG decided to take the fourth perspective in attempting to meet the Governor's emission reduction targets. A detailed discussion of the issues involved appears in Chapter 2 and Appendix D.[8]

The *Inventory and Projections* revealed substantial emissions growth rates and related policy challenges. Figure 1-1 shows the reference projections for New Mexico's gross GHG emissions (not counting sequestration) as increasing from 55 MMtCO_2e in 1990 to 90 MMtCO_2e in 2020, growing by 65% over that period. Accounting for sequestration in New Mexico's forests and soil would decrease the gross estimates by about 20 MMtCO_2e in each year, resulting in net emissions of 70 MMtCO_2e in 2020. Figure 1-1 also provides illustrates the sectoral breakdown of forecasted GHG emissions.

[8] Earlier drafts of CCAG documents showed a consumption-based treatment of the fossil fuel production sector, but discussions late in the process result in the CCAG approving a more conventional production-based approach.

Figure 1-1. Gross GHG Emissions by Sector, 1990-2020: Historical and Projected (Consumption-based Approach)



The inventory and projection of New Mexico's GHG emissions provided several critical findings, including:

- As is common in many states, the electricity and transportation sectors are two of the sectors with the largest emissions, and are expected to grow faster than other sectors in the years ahead.
- A significant portion (over 20%) of New Mexico's emissions are attributable to fossil fuel production (not merely the end-use consumption of fossil fuels). In many states, this sector's contribution is negligible.

While New Mexico's emissions growth rate presents challenges, it also provides major opportunities. Key choices on technologies and infrastructure can have a significant impact on the emissions of a fast-growing state. The CCAG's recommendations document the opportunities for the State to reduce its GHG emissions while continuing its strong economic growth by being more energy efficient, using more renewable energy sources and increasing the use of cleaner transportation modes, technologies and fuels. The inventory and reference case projections are discussed in more detail in Chapter 2 of this report and the entire study appears in Appendix D.

Overview of CCAG Policy Recommendations

The CCAG is making 69 policy recommendations to the Governor to help meet the GHG emissions goals in Executive Order 05-033. If implemented, the recommendations are projected to reduce the State's GHG emissions by 35 MMtCO_2e by 2020. Figure 1-2 below illustrates the level of reductions that this goal would achieve compared to the projected growth in New

Mexico's GHG emissions (the "reference case" forecast of emissions). Table 1-1 provides the numeric estimates underlying Figure 1-2.

Figure 1-2

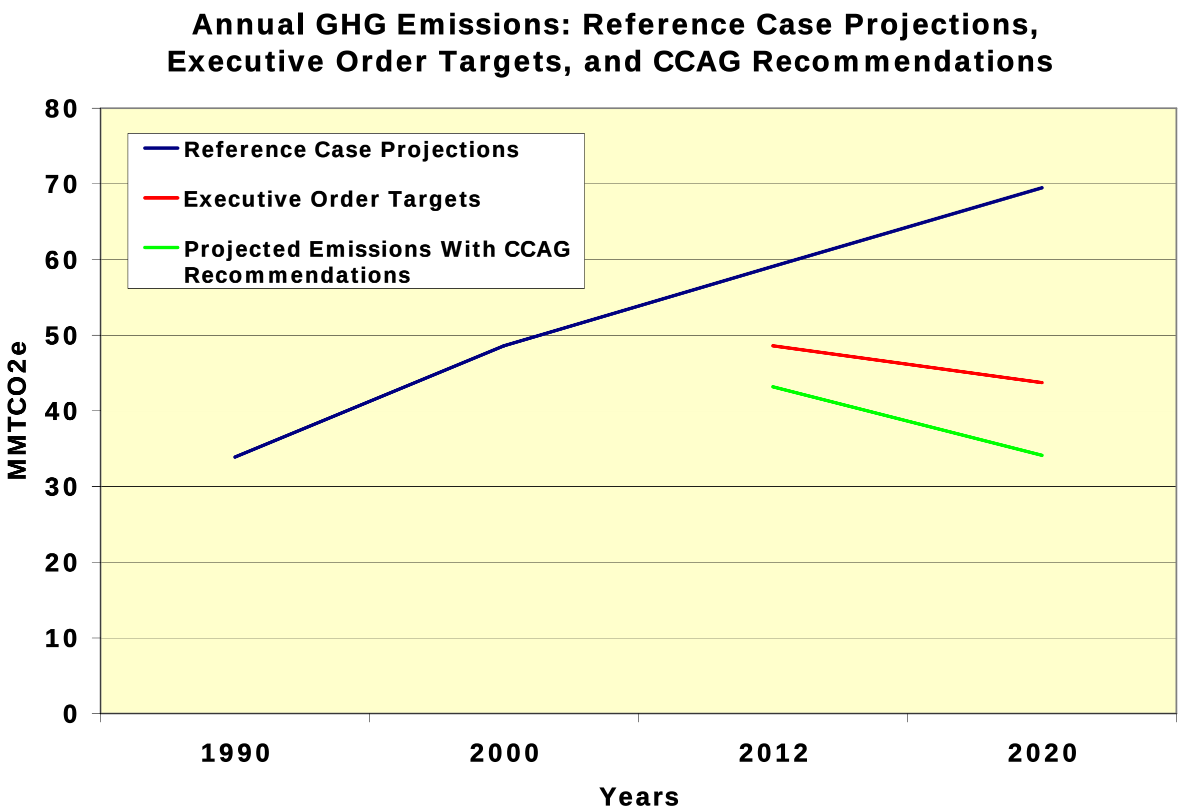


Table 1-1. Annual Emissions: Reference Case Projections, Executive Order Targets, and CCAG Recommendations

ANNUAL EMISSIONS	1990	2000	2012	2020
REFERENCE CASE PROJECTIONS	**33.9**	**48.6**	**59.1**	**69.5**
EXECUTIVE ORDER TARGETS [a]			**48.6**	**43.7**
GHG REDUCTIONS FROM CCAG RECOMMENDATIONS			***-15.9***	***-35.4***
ANNUAL EMISSIONS WITH CCAG RECOMMENDATIONS			**43.2**	**34.1**

[a] Targets aim to reduce New Mexico GHG emissions to 2000 levels by 2012, and 10% below 2000 levels by 2020.

The Governor's goals are consistent with the levels and framework of goals set by other states, including those in the West, that are implementing GHG reduction strategies. Table 1-2 below shows how New Mexico's goals compare with the goals set by other states.

Table 1-2

STATE	GHG REDUCTION GOALS & TIMELINES
AZ	2000 levels by 2020; 50 percent below 2000 levels by 2040
CA	2000 levels by 2010; 10 percent below by 2020; 80 percent below by 2050
CT	1990 levels by 2010; 10 percent below by 2020; 75 percent below by 2050
MA	1990 levels by 2010; 10 percent below by 2020; 75 percent below by 2050
ME	1990 levels by 2010; 10 percent below by 2020; 75 percent below by 2050
NJ	5 percent below 1990 by 2005
NM	2000 by 2012; 10 percent below by 2020; 75 percent below 2050
NY	5 percent below 1990 by 2010
OR	1990 by 2010; 10 percent below by 2020; 75 percent by 2100
RI	1990 by 2010; 10 percent below by 2020; 75 percent by 2050
VT	25 percent below 1990 levels by 2012; 50 percent below 2028; 75 below by 2050
WA (Puget Sound)	1990 by 2010; 10 percent below by 2020; 75 percent by 2100

For New Mexico, as for any state above, meeting a near-term reduction goal will require prompt and energetic implementation of the required GHG reduction policies by State government and all stakeholders. Meeting longer-term goals will require a consistent commitment by successive governors and legislatures, aided by an equal commitment by those same stakeholders. An added challenge in New Mexico relates to the fact that a substantial portion of New Mexico's GHG emissions in the electricity sector come from power plants located on tribal lands that are not subject to state regulatory authority and from electric cooperatives that are under limited state regulatory authority. The electricity sector GHG reductions estimated here assume that tribes and electric cooperatives will adopt policies parallel to the state policies recommended by the CCAG. Thus cooperation and participation of the tribes and the co-ops in the effort to reduce New Mexico's emissions is critical.

The CCAG's recommendations are summarized briefly in words and tabular form in the Executive Summary, along with rankings of the options in terms of total GHG reductions and cost (or cost savings). Chapters 3 through 7 and the Appendices provide detailed descriptions and analysis of GHG reductions, costs, additional impacts, feasibility, etc. for individual options developed by the five Technical Work Groups:

- Cross Cutting Issues (CC)
- Residential, Commercial, Industrial (RCI)
- Energy Supply (ES)
- Transportation and Land Use (TLU)
- Agriculture and Forestry (AF)

Although not prepared in coordination with other state and regional actions, the recommendations adopted by the CCAG are consistent with and supportive of resolutions adopted by the Western Governors Association (WGA), including those adopted at its June 2006 annual meeting in Sedona, Arizona, pertaining to "Regional and National Policies Regarding Global Climate Change,"[9] "Clean and Diversified Energy for the West,"[10] and "Transportation Fuels for the Future,"[11] as well as the recommendations of the WGA's Clean and Diversified Energy Advisory Committee.[12]

The CCAG's recommendations also complement other efforts underway in New Mexico, outlined at the beginning of this chapter. This underscores the potential co-benefits of the CCAG's recommended policy options.

[9] Resolution 06-3 http://www.westgov.org/wga/policy/06/climate-change.pdf.
[10] Resolution 06-10 http://www.westgov.org/wga/policy/06/clean-energy.pdf.
[11] Resolution 06-20 http://www.westgov.org/wga/policy/06/futurefuels.pdf.
[12] http://www.westgov.org/wga/meetings/am2006/CDEAC06.pdf.

Chapter 2
Inventory and Projections of GHG Emissions

Introduction

Executive Order 05-033 directed the NMED to prepare an inventory of New Mexico's greenhouse gas (GHG) emissions and a projection of future emissions. NMED requested the Center for Climate Strategies (CCS) to prepare a draft document for this purpose, and to request the CCAG and its Technical Work Groups to review the methodology, assumptions, and conclusions. The CCAG conducted this review, and at its third meeting, it unanimously approved the final document, *New Mexico Greenhouse Gas Emissions Inventory and Reference Case Projections, 1990-2020* (hereafter, the *Inventory and Projections,* Appendix D to this report).

This chapter presents a summary of the full study, *Inventory and Projections*, and includes the emission estimates (historical and projected) along with key methodological issues and uncertainties. These estimates are intended to assist the State and stakeholders understand past, current, and possible future greenhouse gas (GHG) emissions in New Mexico, and thereby inform the policymaking process.

Historical GHG emissions estimates (1990 through 2003)[1] were developed using a set of generally-accepted principles and guidelines for State greenhouse gas emissions, as described in Section 2, relying to the extent possible on New Mexico-specific data and inputs.[2] The reference case projections out to 2020 are based on a compilation of various existing New Mexico and regional projections of electricity generation, fuel use, and other GHG emitting activities, along with a set of simple, transparent assumptions described later in this chapter.

Inventory and Projections covers the six types of gases included in the US Greenhouse Gas Inventory: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6). Emissions of these greenhouse gases are presented using a common metric, CO2 equivalence (CO2e), which indicates the relative contribution of each gas, per unit mass, to global average radiative forcing on a Global Warming Potential (GWP) weighted basis.

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[1] For some sectors and sources, historical data are only available through 2000, 2001 or 2002.

[2] A starting point for this analysis was the 1996 New Mexico GHG emissions inventory prepared by the Waste Management Education and Research Consortium (WERC) as part of *New Mexico Greenhouse Gas Action Plan: Enhancing our Future through Mitigation* (WERC 2002). This report included a single historical year (1996) and a more limited set of emissions sources and gases than included here. WERC is a consortium of the New Mexico State University, the University of New Mexico, the New Mexico Institute of Mining and Technology, and Diné College in collaboration with Sandia National Laboratories and Los Alamos National Laboratory.

New Mexico Greenhouse Gas Emissions: Sources and Trends

Initial analysis suggests that in 2000, New Mexico produced about 83 million metric tons[3] (MMt) of *gross* carbon dioxide equivalent (CO2e) emissions, an amount equal to 1.2% of total *gross* US GHG emissions.[4] Gross emissions include all major sources and gases, most notably the combustion of fossil fuels in power plants, vehicles, buildings, and industries (82% of total State emissions), the release of methane from oil and gas production, coal mines, agriculture, and waste management (13%), and other sources such industrial processes and nitrous oxide from agricultural soils (5%).

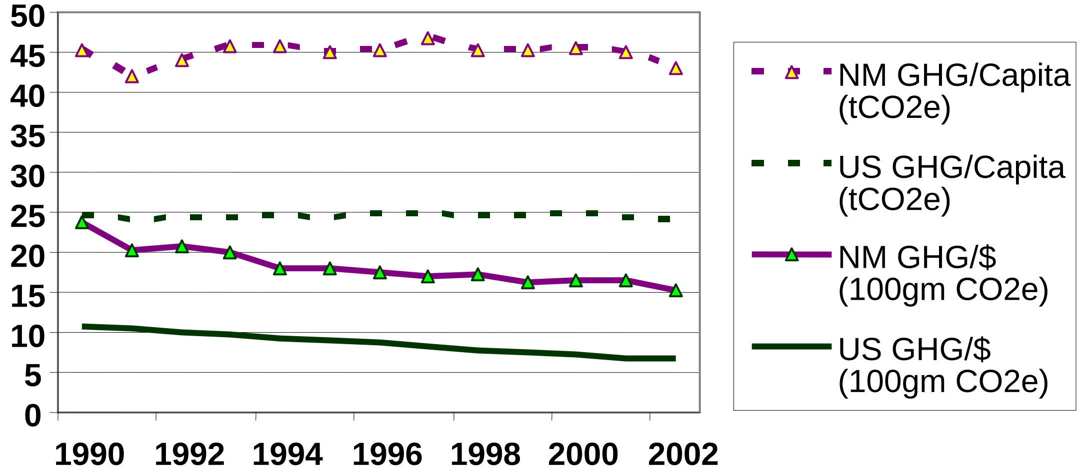
Net emissions combine gross emissions sources with carbon sequestered and released from biomass throughout the State. Very preliminary estimates suggest that from the late 1980s through the late 1990s, New Mexico's forest areas sequestered about 21 MMtCO_2e per year. If these estimates are applied to 2000, the State's *net* GHG emissions would be 62 MMtCO_2e, about 25% lower than the gross emissions estimate. However, there are rather large uncertainties regarding changes in carbon stocks in New Mexico forestlands since 1997, the year that the US Forest Service conducted its most recent forest inventory in the State, especially given drought and disease conditions since that time. Therefore, we focus most of this section on gross emissions sources, for which there is greater certainty. Net emissions are also shown below, using the only historical estimates available as a placeholder until better estimates are available.

The State's gross GHG emissions increased by about 21% during the 1990s, somewhat slower than the US as a whole, where emissions rose by 23%. This slower increase appears largely attributable to a few key factors, in particular limited growth in new power generation facilities and the decline of the mining industry and its fuel and electricity requirements. Were it not for these factors, New Mexico's emissions could well have increased as fast as, or faster than, the national average, given the State's more rapid population and economic growth.[5] Transportation-related GHG emissions, which are driven directly by fuel use and in turn by population, rose by 29% in the 1990s, and represent one of the State's fastest growing GHG emissions sources.

On a per capita basis, New Mexico produces near twice the GHG emissions as the national average (45 vs. 25 tCO2e per person). New Mexico's high per capita emissions are largely the result of its GHG-intensive gas, oil, and electricity production industries. Figure 2-1 shows that, like the nation as a whole, per capita emissions have remained fairly flat, while economic growth outpaced emissions growth throughout the 1990-2002 period. During the 1990s, gross GHG emissions per unit of gross product dropped by 33% nationally, and by 31% in New Mexico.

[3] All GHG emissions are reported here in metric tons.
[4] United States emissions estimates are drawn from Climate Analysis Indicators Tool (CAIT) version 1.5. (Washington, DC: World Resources Institute, 2003), which is based on official USEPA reports. Available at: http://cait.wri.org.
[5] During the 1990s, population grew by 20% in New Mexico compared with 13% nationally, and state GSP grew by 76% compared with national GDP growth of 72%.

Figure 2-1. New Mexico and US GHG Emissions, Per Capita and Per Unit Gross Product (2000$)



In addition to being a key facet of the State's economy, as noted, energy producing industries are the dominant feature of New Mexico's GHG emissions profile. Together, the production of electricity and fossil fuels accounted for two-thirds of New Mexico's gross GHG emissions in the year 2000, as shown in Figure 2-2. In comparison, these activities accounted for only 35 to 40% of national gross GHG emissions.[6]

Emissions of greenhouse gases by electric power plants, the State's leading emission source, are relatively well understood, and are for the most part (carbon dioxide at facilities over 25 MW) continuously monitored. Over 90% of these emissions occur at the State's coal-fired facilities, and two plants, San Juan and Four Corners, account for about three-quarters. Natural gas-fired power plants produce the remaining emissions from this sector.

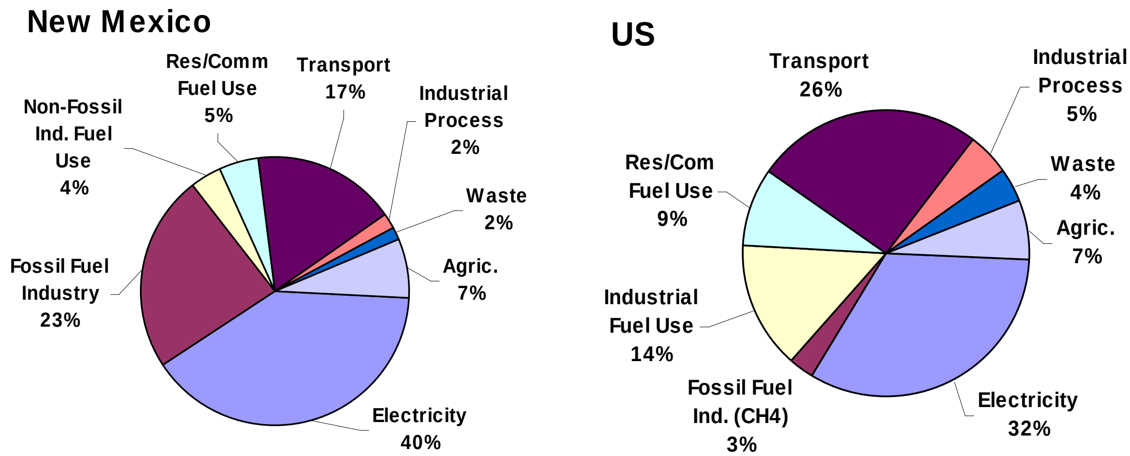
Emissions of carbon dioxide and methane occur at many stages of the fossil fuel production and delivery process (drilling, production, processing/refining, and pipeline transport), and can be highly dependent upon local resource characteristics (e.g., pressure, depth, water content, gas concentrations), technologies applied, and practices employed at individual wells sites and compressor stations. With over 40,000 oil and gas wells, three oil refineries, several gas processing plants, and tens of thousands of miles of gas pipelines in the State – and no regulatory requirements to track CO_2 or CH_4 emissions – there are significant uncertainties with respect to the State's GHG emissions from this sector.

Preliminary estimates however, suggest that fossil fuel industry emissions are quite high. The majority of emissions come from natural gas production, with significant emissions resulting from fuel use at field sites, processing plants, and pipelines (6 $MMtCO_2e$), the release of associated CO2 found in the coalbed methane from the Fruitland field in the San Juan Basin (5

[6] Fuel use for field, processing, and pipeline operations are included in the fossil fuel industry for New Mexico; however, such fuel use is not disaggregated in the national inventory, and thus constitutes a fraction of the slice shown for US industrial fuel use.

MMtCO_2e), and methane vented and flashed at well sites, processing plants, and pipelines (5 MMtCO_2e). Further analysis is needed to resolve some of the large unknowns regarding these and other oil and gas sector emissions.

Figure 2-2. Gross GHG Emissions by Sector and Gas, 2000, New Mexico and US



As a fraction of total GHG emissions, transportation accounted for 17% of New Mexico emissions, compared with 26% of national emissions. However, on a per capita basis, New Mexicans actually consume more gasoline and diesel fuel, and produce more transportation-related GHG emissions, than the average American.

The remaining use of fossil fuels – natural gas, oil products, and coal -- constitutes another 9% of State emissions, about half in residential and commercial buildings and the other half among non-fossil-fuel industrial (RCI) sectors. While GHG emissions from residential and commercial fuel use grew about 10% from 1990 to 2000, industrial fuel use grew in the early 1990s, but has since declined, most likely a reflection of reducing mining and smelting activity in the State.

Agricultural activities such as manure management, fertilizer use, and livestock (enteric fermentation) result in methane and nitrous oxide emissions that account for 7% of State GHG emissions. Industrial process emissions comprise about 2% of State GHG emissions today. Landfills and wastewater management facilities produce methane and nitrous oxide emissions accounting for the remaining 2% of current State emissions in 2000.

Reference Case Projections

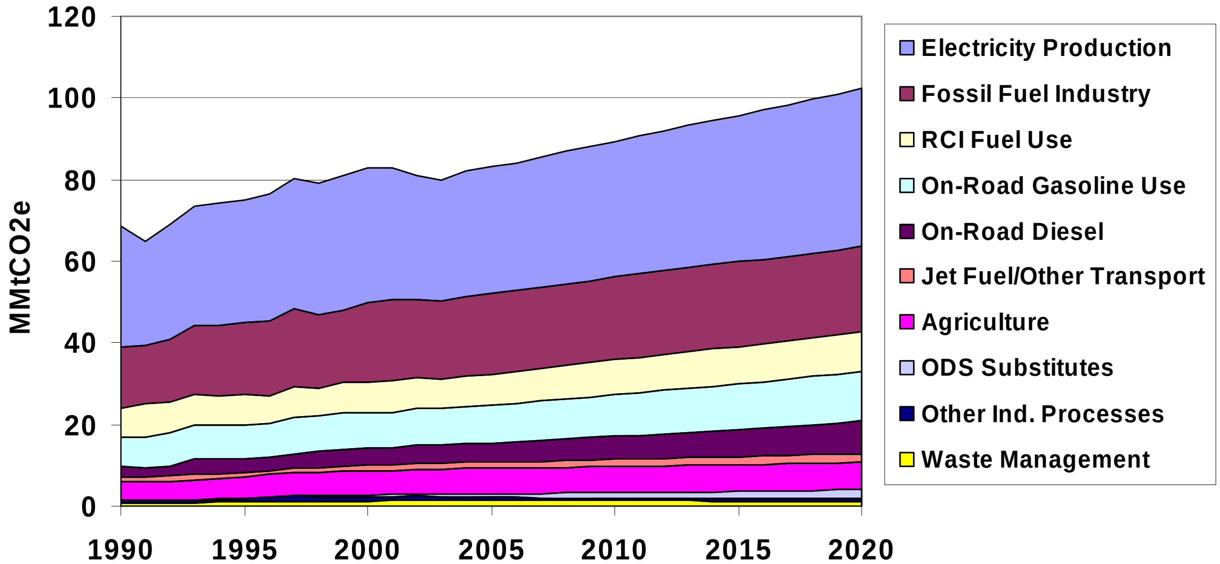
Relying on US DOE and New Mexico agency projections of population, employment, and electricity use, input from NMED staff and industry experts, we developed a simple reference case projection of GHG emissions through 2020.[7] The reference case assumes a continuation of current trends and reflects, to the extent possible, power plants under construction and the implementation of recently enacted policies, such as the State's Renewable Portfolio Standard,

[7] Historical data runs through 2001 to 2003 depending on the emissions source.

which currently requires investor-owned utilities to provide 10% of the electricity sales from renewable sources by 2011.[8]

As illustrated in Figure 2-3 and shown numerically in Table 2-1, under the reference case projection, New Mexico's gross GHG emissions are projected to grow steadily from recent levels. (For more details on emissions by source, see Table 2-5 at the end of this section.) By 2010 they would reach 89 $MMtCO_2e$, 8% above year 2000 levels. By 2020, they would climb another 14% to 102 $MMtCO_2e$, which corresponds to a total increase of 23% above year 2000 levels. These decadal increases would be slower than New Mexico's 21% increase in GHG emissions from 1990 to 2000.

Figure 2-3. Gross GHG Emissions by Sector, 1990-2020: Historical and Projected (Production-based Approach)



[8] http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=NM05R&state=NM&CurrentPageID=1

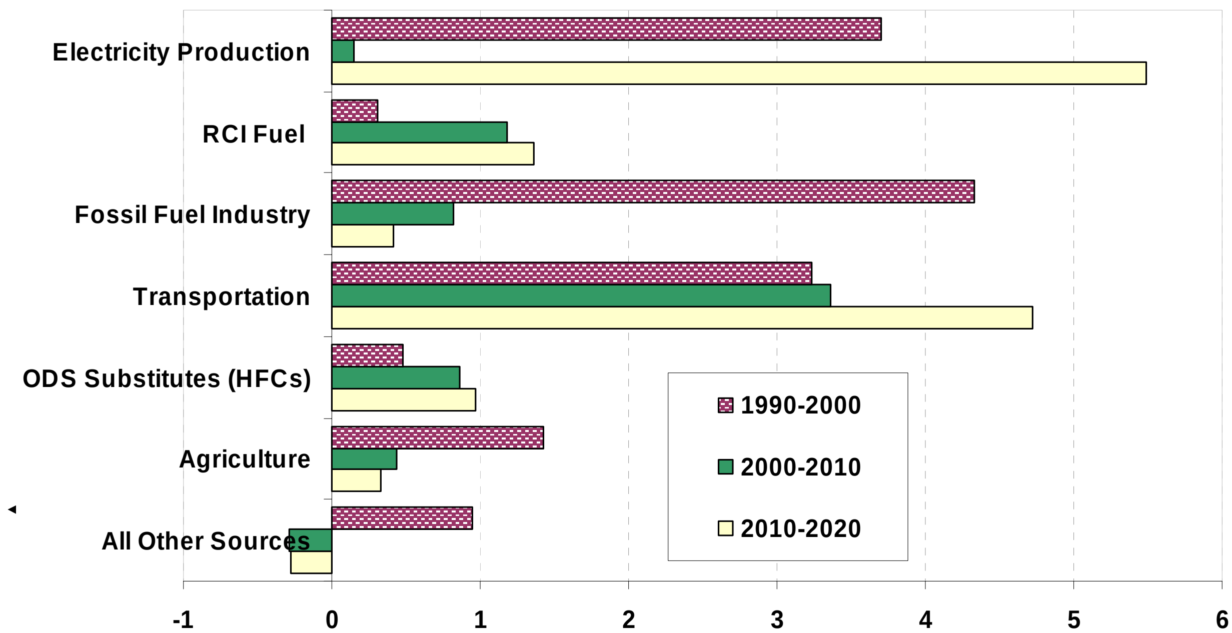
Table 2-1. New Mexico GHG Emissions, Reference Case – Production Based[9]

(Million Metric Tons CO2e)	1990	2000	2010	2020
Energy	**62.6**	**74.2**	**79.7**	**91.7**
Electricity Production	29.5	33.2	33.3	38.8
Transportation Fuel Use	11.0	14.2	17.6	22.3
Fossil Fuel Industry	15.2	19.5	20.3	20.7
Res/Comm/Other Ind. Fuel Use	7.0	7.3	8.5	9.9
Other	**5.9**	**8.7**	**9.7**	**10.8**
Industrial Processes	0.5	1.5	2.0	2.8
Agriculture	4.5	6.0	6.4	6.7
Waste Management	0.8	1.2	1.4	1.2
Gross Emissions	**68.5**	**82.9**	**89.4**	**102.4**
change relative to 1990		*+21%*	*+31%*	*+48%*
change relative to 2000			*+8%*	*+23%*
Forestry and Land Use	***-20.9***	***-20.9***	***-20.9***	***-20.9***
Net Emissions (includes Forestry and Land Use)	**47.6**	**62.0**	**68.5**	**81.5**
change relative to 1990		*+30%*	*+44%*	+71%
change relative to 2000			*+11%*	+31%
Per Capita Gross Emissions (Mt)	45	46	42	43
Per Capita Net Emissions (Mt)	31	34	32	34

These different rates of growth by decade can be explained by looking more closely at changes by sector, as shown in Figure 2-4.

[9] The numbers in this table reflect a minor update to the original draft inventory and forecast report. A reporting error for coal-based electricity production, whereby coal-based electricity production was held flat 2018-2020, was found and fixed. The net effect is to increase emissions by 0.7 MMtCO2 in 2020 emissions.

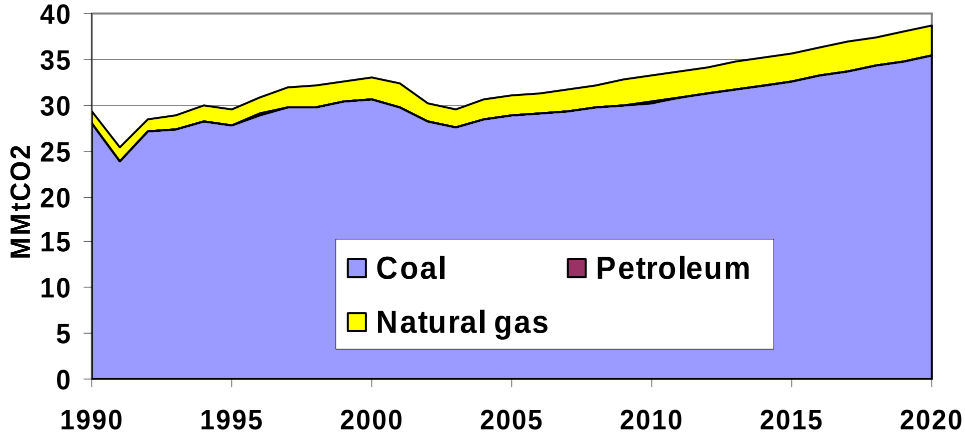
Figure 2-4. Contributions to Emissions Growth, 1990-2020: Reference Case Projections ($MMtCO_2e$)



As shown, electricity production emissions grew significantly from 1990 to 2000, as existing coal plants increased production and two new power plants came on line.[10] The year 2000 was also the time of the Western power crunch, where drought conditions on the West Coast, and other market factors led to increase demands for power on the Western grid system. Electricity production has since declined, and only recently returned to 2000 levels. With much of new electricity capacity this decade expected to come from natural gas and wind facilities, growth in statewide electricity emissions is likely to be limited. However, during the 2010-2020 period, with gas prices rising and several new coal plants being proposed, electricity emissions could rise rapidly again, as illustrated in Figure 2-5 below.

[10] Increased generation from existing plants accounted for 90% of the increase in emissions from 1990 to 2000. Generation from the Four Corners coal plant did not change significantly, however generation at the San Juan coal plant increased by 33%, Escalante generation increased by 20%, and Rio Grande generation almost doubled. The Delta Person plant came on-line in 2000 (150MW) and the Milagro cogeneration unit in 1996 (61 MW). Note that CO2 emissions from biomass-fired combustion are not counted as net GHG emissions, consistent with USEPA and UNFCCC practices. To the extent that use of biomass energy leads to changes in carbon stocks in farms and forests, these standard methods suggest that this should be captured in forest and land use accounting.

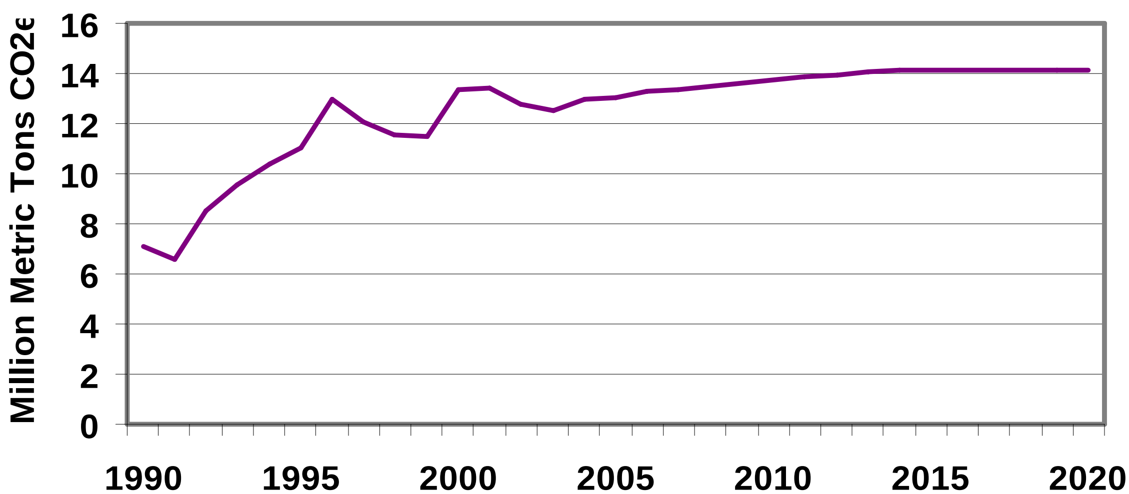
Figure 2-5. CO2 Emissions from Electricity Production in New Mexico, by Fuel Source



Fossil fuel industry emissions in New Mexico grew rapidly in the 1990s with total natural gas production rising from 1015 billion cubic feet in 1990 to 1802 billion cubic feet in 2000. Natural gas production has dropped slightly since 2000. The future of New Mexico natural gas and oil production is highly uncertain, dependent on global price trends, discovery of new reserves, and other factors. For projection purposes, we assume that new reserves will be found and exploited such that recent production levels of oil and gas will be maintained.[11]

The implication of this forecast in terms of GHG emissions is illustrated in Figure 2-6 below. This chart shows GHG emissions from the natural gas production and processing stages, the principal emissions sources for the oil and gas industry, and those most likely to be affected by future changes in production. GHG emissions from gas production and processing activities remain relatively constant from 2003 onward, with a slight increase owing to the increasing concentration of CO2 over time in coalbed methane production.

Figure 2-6. GHG Emissions from Natural Gas Production and Processing



[11] The Energy Supply Technical Working Group reviewed and affirmed this assumption for projection purposes.

As Figure 2-4 shows, the transportation sector is expected to be the leading source of overall GHG emissions growth from 2000 onward. Under the assumptions described in the transportation section (see Appendix D for details), increasing diesel use for freight transport is projected to account for nearly half of this growth (3.7 $MMtCO_2e$ from 2000 to 2020). Increasing gasoline use would account for nearly as much growth (3.5 $MMtCO_2e$), driven largely by State population growth, while rising jet fuel use would account for the remainder (0.8 $MMtCO_2e$).

Other key sources of emissions growth include direct use of fuels in the residential, commercial, and non-fossil fuel industrial sectors, the switch to use of HFCs as substitutes for ozone-depleting substances, and methane emissions from dairy herds.

Consumption vs. Production-Based Emissions

As noted, New Mexico's emissions are well above the national average largely because of coal-based electricity generation and natural gas production activities, a significant fraction of which meets needs in other states. This situation raises an important question with respect to how these emissions should be addressed from an accounting and policy basis. In other words, should states focus on: a) all emissions produced within the State (*production-based emissions*), or b) the emissions associated with production of electricity, natural gas, and/or other energy-intensive products consumed within the State (consumption-based emissions).

Reporting production-based emissions has the advantages of simplicity and consistency with typical inventory methods. If used for policy purposes, e.g. for setting emission reduction goals and tracking progress in meeting them, production-based reporting will account for changes in emissions resulting from new in-state power plants or gas production facilities, even if such facilities are built largely to serve out-of-state consumption. Conversely, future declines in natural gas production, due for example to the depletion of gas reserves as noted, could lead to significant reductions in reported State emissions related to gas production activities. Such changes in the State's reported emissions could be very significant, and but may also be rather difficult to predict or manage. Furthermore, one could argue that these changes do not reflect "real" emissions changes, if electricity or gas consumers would otherwise source their electricity or gas from similar sources in other states or countries.

In contrast, reporting consumption-based GHG emissions can be more complex from an accounting perspective. However, the consumption-based approach may also better reflect the emissions (and emissions reductions) associated with consuming activities occurring within the State, particularly with respect to electricity use (and efficiency improvements), and is thus may be useful in a policy context. Under this approach, emissions associated with electricity exported to other states would need to be covered in those states' accounts in order to avoid double counting or exclusions (indeed, California, Oregon, and Washington are currently considering such an approach). The consumption-based approach also leads to projections that are likely to be less volatile (subject to major changes), and future GHG emissions are perhaps more directly influenced by state-based policy strategies such as energy efficiency on overall emissions.

However, developing a robust tracking system for a consumption-based approach could be rather challenging.

For this inventory, we prepared simplified consumption-based estimates for the electricity sector. We estimated the ratio of in-State electricity consumption to total production, and applied this ratio to the total GHG emissions from that sector. (See Table 2-4 near the end of this chapter.) While this method may not precisely reflect the sources of electricity used to meet in-state demands, it does provide a rough guide.

The result of these calculations is shown in Figure 2-7 and Table 2-2 below. Emissions related to electricity use are about 30-40% lower than for electricity production, reflecting the fact that the State produces about 30-40% more electricity than it needs for its own use.

Figure 2-7. Gross GHG Emissions by Sector, 1990-2020: Historical and Projected (Consumption-based Approach – Electricity Sector)

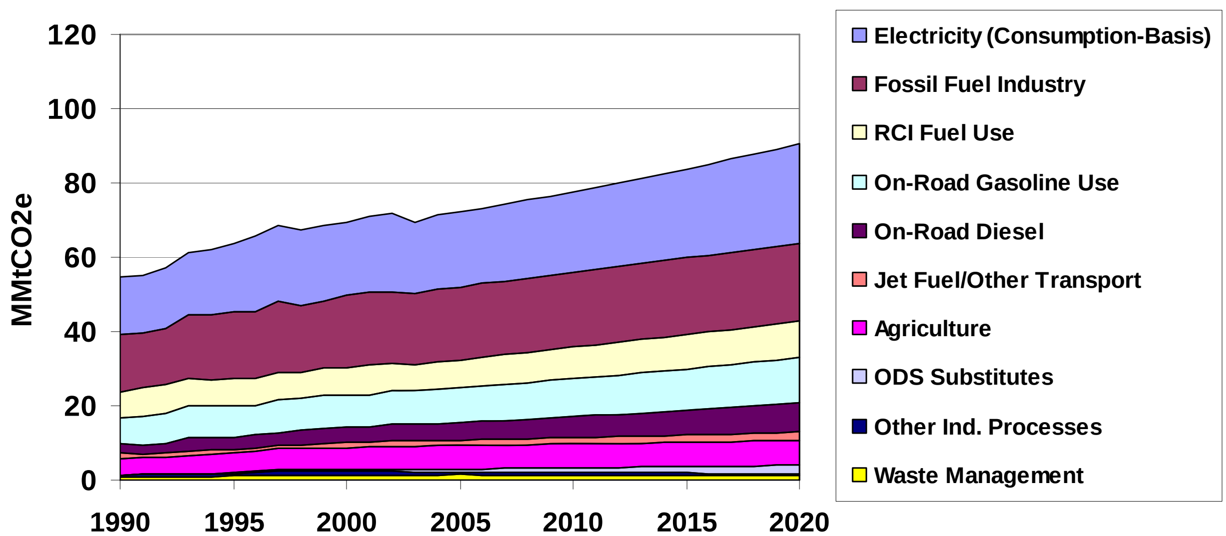


Table 2-2. New Mexico GHG Emissions, Reference Case – Consumption Based[12]

(Million Metric Tons CO2e)	1990	2000	2010	2020
Energy	**48.9**	**60.7**	**67.8**	**79.7**
Electricity Use	15.8	19.7	21.4	26.8
Transportation Fuel Use	11.0	14.2	17.6	22.3
Fossil Fuel Industry	15.2	19.5	20.3	20.7
Res/Comm/Other Ind. Fuel Use	7.0	7.3	8.5	9.9
Other	**5.9**	**8.7**	**9.7**	**10.8**
Industrial Processes	0.5	1.5	2.0	2.8
Agriculture	4.5	6.0	6.4	6.7
Waste Management	0.8	1.2	1.4	1.2
Gross Emissions	**54.8**	**69.5**	**77.5**	**90.4**
change relative to 1990		27%	41%	65%
change relative to 2000			12%	30%
Forestry and Land Use	***-20.9***	***-20.9***	***-20.9***	***-20.9***
Net Emissions (incl. forestry)	**33.9**	**48.6**	**56.6**	**69.5**
change relative to 1990		43%	67%	105%
change relative to 2000			17%	43%
Per Capita Gross Emissions	36	38	37	38
Per Capita Net Emissions	22	27	27	29

Key Uncertainties

As in any exercise of this nature, there are still data gaps and uncertainties in the inventory and projections. Closer review of the many sources of oil and gas sector emissions and estimates of future oil and gas production could improve projections of New Mexico's future GHG emissions. Key drivers of GHG growth rates include inherently uncertain economic, demographic, and land use trends (including growth patterns and transportation system impacts), Table 2-3 presents the assumptions used in this study.

[12] The numbers in this table reflect a significant technical change to the original draft inventory and forecast report that used a consumption-based approach for the fossil fuel industry. Late in the process, the CCAG approved production-based approach to this industry. As an example of the consequent changes, this increased the 2020 projection for the industry by 14 MMT and this change flowed through to energy total, gross emissions total, etc.

Table 2-3. Key Annual Growth Rates, Historical and Projected

	Historical 1990-2000	Projected 2000-2020	Sources/Uses
Population*	1.8%	1.4%	New Mexico Department of Labor, 2004. New Mexico Annual Social and Economic Indicators
Employment*	2.4%	2.1%	
Electricity sales	3.1%	2.5% from 2002 on	EIA SEDS for historic, projections based on EMNRD input.
Electricity production	1.6%	2.2% from 2004 on	Based roughly on AEO 2005 for the region; subject to very large uncertainties
Personal Vehicle Miles Traveled*	2.9%	1.9%	New Mexico 2025 Statewide Multimodal Transportation Plan (historical from FHWA Transportation Statistics)
Freight Vehicle Miles Traveled*	6.9%	3.6%	

* Population, employment and VMT projections for New Mexico were used together with US DOE's Annual Energy Outlook 2005 projections of changes in fuel use on a per capita, per employee, and per VMT, as relevant for each sector. For instance, growth in New Mexico residential natural gas use is calculated as the New Mexico population growth times the change in per capita New Mexico natural gas use for the Mountain region. New Mexico population growth is also used as the driver of growth in cement production, soda ash consumption, solid waste generation, and wastewater generation.

In addition, the following three areas are subject to considerable uncertainty, not simply because the future is hard to predict, but because of limited data availability and scientific understanding:

- **Oil and gas sector emissions:** As noted above, the sheer number and diversity of different GHG-emitting activities, combined with the fact that GHG emissions are typically unmonitored, means that there is significant uncertainty with regard to emission levels. Local estimates of field gas use and provided by the New Mexico Oil and Gas Association (NMOGA) suggest the top-down estimates of natural gas production-related emissions provided here (based on national average emission rates) may be low. Furthermore, CO2 emissions that may occur as the result of CO2 mining and use for enhanced oil recovery could be significant, but have not been estimated. Further analysis of emissions from activities in all of the State's principal gas and oil basins, as well as of emissions from transmission and distribution sources could help to resolve some of these uncertainties. Given the large emission reduction potential that may exist in these sectors, such efforts could be quite valuable.

- **Terrestrial carbon emissions and sinks:** The net forest and land use sequestration estimates noted above are based on recent improvements to US Forest Service carbon stock inventory data but do not fully address all issues that impact the quality of the emission estimates.

  For instance, US Forest Service assessments only cover the parts of the State that the US

Forest Service defines as forest, which represented 27% of the total State land area in 1997. Between the dates of the two most recent forest inventories, 1987 and 1997, the Forest Service changed its technical definition of forestland from minimum of 10% canopy cover to a minimum 5% cover. As a result, later years in the inventory period report increased carbon stocks due to this definitional change. According the US Forest Service contacts, there is no ability on their part to normalize the forested acreage to a single definition (either 5% or 10%). However, the overall impact of the change in forest definition is expected to be small in comparison to other forest carbon modeling issues, including a lack of carbon measurements in pinyon/juniper systems (an important land cover type in NM).

To the extent that rangelands may sequester or emit carbon, while small on a per acre basis, they may be quite significant at the State level. This is due to the large amount of rangeland cover present in New Mexico. However, the carbon cycle for rangelands is not well understood, and the current inventory does not include rangeland carbon sequestration estimates. Additional research in this area is recommended.

Another data limitation arises from the lack of inventory data since 1997. Due to funding constraints in New Mexico, US Forest Service data from the Forest Inventory Analysis (FIA) are not available from 1997 onward. As a result, biomass reductions from wildfires and forest health problems, or other carbon stock changes since that time, are not reflected in the estimates provided here. These changes need to be clarified to provide accurate forest carbon projections. For the time being, forest carbon projections are based solely on a linear extrapolation of the 1987-1997 period for which data are available, and do not factor in the effects of potential future changes in forest health, productivity and use.

- **Black carbon and other aerosol emissions.** Emissions of aerosols, particularly black carbon from fossil fuel and biomass combustion, could have potential significant impacts in terms of radiative forcing (i.e. climate impacts). Methodologies for conversion of black carbon mass estimates and projections to global warming potential involve significant uncertainty at present. This inventory and forecast does not attempt to estimate these other potential contributors to climate change.

Table 2-4. Simplified Calculation of Consumption-Basis Emissions for Electricity Sector

	1990	2000	2010	2020	units
Electricity					
Electricity Produced (net of RPS)	29	34	37	44	TWh
In-State Electricity Needs (net of RPS)	15	20	24	30	TWh
in-state share	*54%*	*59%*	*64%*	*69%*	
Electricity Production Emissions	29	33	33	39	MMtCO2e
Consumption-Basis Emissions	16	20	21	27	MMtCO2e

Table 2-5. Reference Case, Production-Based GHG Emissions, Detailed Results

(Million Metric Tons CO2e)	1990	2000	2010	2020	Explanatory Notes for Projections
Electricity Production	**29.5**	**33.2**	**33.3**	**38.8**	
Coal	28.0	30.7	30.4	35.5	See electric sector assumptions
Natural Gas	1.4	2.5	2.9	3.2	in Appendix D
Oil	0.0	0.0	0.0	0.0	
Res/Comm/Non-Fossil Ind (RCI)	**7.0**	**7.3**	**8.5**	**9.9**	
Coal	0.1	0.2	0.2	0.2	Based on USDOE regional projections
Natural Gas	3.8	4.6	4.5	5.4	Based on USDOE regional projections
Oil	3.1	2.5	3.8	4.3	Based on USDOE regional projections
Wood (CH4 and N2O)	0.0	0.0	0.0	0.0	Assumes (for now) no change after 2003
Transportation	**11.0**	**14.2**	**17.6**	**22.3**	
On-road Gasoline	7.2	8.7	10.2	12.2	VMT from NMDOT, constant energy/VMT
On-road Diesel	2.5	4.2	5.6	7.9	VMT from NMDOT, constant energy/VMT
Natural Gas, LPG, Other	0.1	0.1	0.1	0.1	Based on USDOE regional projections
Jet Fuel and Aviation Gasoline	1.2	1.2	1.6	2.0	Based on USDOE regional projections
Fossil Fuel Industry	**15.2**	**19.5**	**20.3**	**20.7**	
Natural Gas Industry	12.7	17.0	17.3	17.7	Assumes no change in state gas production
Oil Industry	2.3	2.3	2.3	2.3	Assumes no change in state oil production
Coal Mining (Methane)	0.2	0.2	0.7	0.7	Assumes no change after 2003
Industrial Processes	**0.5**	**1.5**	**2.0**	**2.8**	
ODS Substitutes	0.0	0.5	1.3	2.3	Based on national projections (State Dept.)
PFCs in Semi-conductor Ind.	0.1	0.5	0.2	0.1	Based on national projections (USEPA)
SF6 from Electric Utilities	0.2	0.1	0.1	0.0	Based on national projections (USEPA)
Cement & Other Industry	0.2	0.4	0.4	0.4	Assumes no change after 2003
Carbon Dioxide Consumption					not yet estimated
Waste Management	**0.8**	**1.2**	**1.4**	**1.2**	
Solid Waste Management	0.6	1.0	1.1	0.9	Based on national projections (State Dept.)
Wastewater Management	0.2	0.2	0.3	0.3	Increases with state population
Agriculture	**4.5**	**6.0**	**6.4**	**6.7**	
Manure Mgmt & Enteric Ferment. (CH4)	2.3	3.5	4.1	4.4	Dairy emissions grow with population
Agricultural Soils (N2O)	2.2	2.4	2.3	2.3	No changes projected
Total Gross Emissions	**68.5**	**82.9**	**89.4**	**102.4**	
Forestry and Land Use	**-20.9**	**-20.9**	**-20.9**	**-20.9**	
Net Emissions (incl. forestry)	**47.6**	**62.0**	**68.5**	**81.5**	

Chapter 3
Goals and Cross-Cutting Issues

Overview of Goals and Projected Impact of CCAG Recommendations

In his Executive Order 2005-033 issued on June 9, 2005, Governor Bill Richardson directed that the CCAG investigate and help create meaningful regional and national policy initiatives to address climate change. Such initiatives are already underway concerning the reporting of GHG emissions and the registration, for possible future recognition or credit, of GHG emission reductions in a "GHG Registry." Governor Richardson also called for recommendations associated with public education and outreach. The CCAG has addressed these directives in the following cross-cutting policy recommendations. Implementation of these recommendations will help ensure that New Mexico's interests are adequately represented in the development of broader regional and national initiatives that are likely to ultimately frame national climate change policy outcomes.

Overview of Cross-Cutting Issues

Some issues relating to climate policy cut across multiple or all sectors. The CCAG addressed such issues explicitly in a separate technical work group as "cross-cutting" issues rather than assigning them to any individual sector. These issues include the reporting of GHG emissions by entities, the registering of any GHG reductions achieved by entities for possible future credit and/or recognition, and a variety of public education and outreach initiatives regarding climate change. The Cross-Cutting Issues Technical Work Group (CC TWG) developed policy options for each of these issues.

At its January 11, 2006 meeting, the CCAG also asked the CC TWG to develop a checklist to define "contributing issues" that warrant consideration when evaluating GHG emission reduction strategies. The list of contributing issues includes important human, social, economic, environmental, and other factors. This checklist was made available to TWGs to consider as they formulated their policy recommendations, and is included at the end of Appendix F.

Key Challenges and Opportunities

The GHG reporting and registry programs referenced above present special challenges and opportunities. Any regional or national effort involves reconciling the interests and perspectives of different states. The states – even in the West – are at much different stages of the learning curve with respect to these and other climate actions. This situation, however, provides New Mexico with unusual opportunity to influence how regional or national cross-cutting programs will be designed and implemented, and correspondingly, how effectively the State's interests will be reflected in these policies. By being the first state to join the Chicago Climate Exchange (CCX), for instance, New Mexico helped reinforce CCX's quantification approaches and protocols (including the WRI/WBCSD *GHG Protocol Initiative*)[1] as appropriate instruments for states, making it more likely that other states will join CCX and/or use the same protocols. New Mexico will also benefit, of course, from the enhanced effectiveness of GHG reporting and registry programs if implemented on a broad regional or national basis instead of through separate, state-by-state efforts. Public education and outreach programs can be difficult to develop and measure, but successful climate action will ultimately hinge on the public's awareness of climate risks and solutions.

Overview of Policy Recommendations

Cross-cutting issues include policies and measures that apply across the board to all sectors and activities. Cross-cutting recommendations typically encourage, enable, or otherwise support emissions mitigation activities and/or other climate actions. The CCAG recommends three such policies be adopted and implemented by the State. All three are enabling policies that are not quantified in terms of tons or costs.

First, a rigorous GHG emissions reporting program is vital to understanding where GHG emissions are coming from and thus where mitigation opportunities lie. A GHG reporting program is also crucial in measuring future progress. Second, a GHG Registry can help recognize and share emission reduction accomplishments. It can also protect entities' interests by rigorously recording their early GHG reduction efforts and accomplishments. Finally, public awareness of climate change is essential to the public's acceptance of concerted climate action, so a comprehensive public education and outreach program is warranted. Detailed descriptions of the individual Cross-Cutting Issues policy options as presented to and approved by the CCAG can be found in Appendix F.

Table 3-1. CCAG Recommended Policy Options and Results for Cross-Cutting Issues

	Policy Option	**GHG Reductions ($MMtCO_2e$)**			**Net Present Value 2007–2020 (Million $)**	**Cost-Effective-ness ($/tCO_2e$)**	**Level of Support**
		2012	**2020**	**Total 2007-2020**			
	CROSS-CUTTING ISSUES						
CC-1	**State Greenhouse Gas Reporting**	***Non-quantified enabling policy***					**UC**
CC-2	**State Greenhouse Gas Registry**	***Non-quantified enabling policy***					**UC**
CC-3	**State Climate Public Education and Outreach**	***Non-quantified enabling policy***					**UC**

[1] http://www.ghgprotocol.org/.

Cross-Cutting Issues
Policy Descriptions

CC-1 State Greenhouse Gas Reporting

GHG reporting reflects the measurement and reporting of GHG emissions to support tracking and management of emissions. GHG reporting can help sources identify emission reduction opportunities and reduce risks associated with possible future GHG mandates by moving “up the learning curve.” Tracking and reporting of GHG emissions can also help in the construction of periodic state GHG inventories. GHG reporting is typically a precursor for sources to participate in voluntary GHG reduction programs, opportunities for recognition, a GHG emission reduction registry, and to secure “baseline protection.” Further, developing a GHG reporting program could enable the state to influence the development of GHG reporting practices throughout the region and nation and build consistency with other state or regional GHG reporting programs.

Accordingly, the CCAG recommends that New Mexico develop and implement a GHG reporting program as soon as possible. In order to encourage GHG mitigation activities from all quarters, GHG reporting should not be constrained to particular sectors or sources. Mandatory reporting should be phased in as standardized quantification protocols, base data, and tools become available, and other entities should be allowed to report GHG emissions voluntarily. The state, municipalities, and other jurisdictions should be allowed to report emissions associated with their own activities and programs. Reporting should be applicable to all sources, targeting organization-wide emissions within New Mexico with greatest possible “granularity” in order to facilitate baseline protection. Every effort should be made to build upon the considerable work already done on reporting structures, issues, protocols, and methodologies in order to maximize consistency and reciprocity with federal, regional, and other states’ GHG reporting programs. GHG emissions reports should be verified through self-certification and NMED spot-checks, but to qualify for future registry purposes, reports should undergo third-party verification. Project-based emissions reporting should be allowed when properly identified as such and quantified with equally rigorous consistency. Finally, the reporting program should apply common sense with respect to de minimis emissions and provide for appropriate public transparency of reported emissions.

CC-2 State Greenhouse Gas Registry

Building upon a rigorous GHG emissions reporting program, a GHG emissions reduction registry reflects measuring and recording GHG emissions reductions in a central repository with a “transaction ledger” capacity to support tracking, management, ownership, and exchange of emission reductions. A GHG Registry provides a framework to enable recognition for GHG reductions, provide baseline protection, and assist in the crediting of actions. A GHG Registry can assist in measuring progress toward emissions reduction goals and provide a mechanism for regional, multi-state, and cross-border cooperation.

Building on the GHG reporting program recommended in CC-1, the CCAG recommends that New Mexico participate in the development of a regional or national GHG registry or develop and implement a state GHG registry as soon as possible. The GHG Registry should strive for maximum consistency with other state, regional, and/or national registry efforts in order to build upon the considerable work already done in this area and to ensure reciprocity with federal, regional, and other states' GHG reporting programs. The GHG Registry should also provide maximum flexibility as GHG mitigation approaches evolve, and require adequate verification to ensure quality. The registry should allow participants to go as far back chronologically as good data exists – as affirmed by third-party verification – and it should allow registration of project-based reductions or "offsets" that can be rigorously quantified. The GHG Registry should provide guidance to assist participants; incorporate safeguards to ensure that reductions aren't double-counted by multiple participants; provide appropriate transparency; and allow the State, counties, and municipalities to be valid participants for reductions associated with their programs, direct activities, or other efforts. Program costs should be borne primarily by participants.

CC-3 State Climate Public Education and Outreach

Public education and outreach is vital to fostering a broad awareness of climate change issues, effects, and opportunities among the State's citizens (including co-benefits, such as clean air and public health). Such awareness is necessary to engage citizens in actions to reduce GHG emissions. Public education and outreach efforts should integrate with and build upon existing outreach efforts involving climate change and related issues in the State. Ultimately, public education and outreach will be the foundation for the long-term success of all the mitigation actions proposed by the CCAG as well as those which may evolve in the future.

The CCAG recommends that New Mexico lead by example in its own education and outreach activities by establishing a pro-active public education and outreach capability and using it to target education and outreach activities to five specific audiences: (a) policymakers (legislators, regulators, executive branch, agencies); (b) younger generations; (c) community leaders and community-based organizations; (d) the general public; and (e) industrial and economic sectors (such as professional training, licensing, and certification programs). Included in the numerous actions recommended are: (1) the creation of one or more "Outreach Coordinator" positions; (2) annual agency-specific reports on GHG reduction progress; (3) educating policymakers on climate change and the CCAG's recommendations; (4) using "best practices" in public schools so as to educate students and parents first-hand; (5) promoting climate research and solutions efforts at state universities; and (6) educating the media about climate change risks and opportunities.

Chapter 4
Residential, Commercial, Industrial, and Waste Management Sectors

Overview of GHG Emissions

The residential, commercial, industrial, and waste management (RCI[1]) sectors are directly responsible for only about one-tenth of New Mexico's current gross GHG emissions (8.8 $MMtCO_2e$ in 2000). Direct emissions result principally from the on-site combustion of natural gas, oil, and coal, the release of CO_2 and fluorinated gases (HFCs, PFCs) during industrial processing (largely cement and semi-conductors), the use of sulfur hexafluoride (SF_6) in the utility industry, and the leakage of HFCs from refrigeration and related equipment.[2]

Considering only the direct emissions that occur within buildings and industries, however, ignores the fact that nearly all electricity sold in the state is consumed as the result of residential, commercial, and industrial activity. If the emissions associated with producing the electricity consumed in New Mexico are considered, RCI activities are associated with over half (about 53 percent) of the state's gross GHG emissions.[3] The State's future GHG emissions therefore will depend heavily on future trends in the consumption of electricity and other fuels in these sectors.

Figure 4-1 shows historical and projected RCI GHG emissions by fuel and source, and illustrates the large fraction of RCI emissions associated with electricity use. RCI emissions associated with electricity and natural gas use are expected to rise by nearly a third between 2000 and 2020, and are likely to account for over 40 percent of the State's growth in gross GHG emissions during this period.[4]

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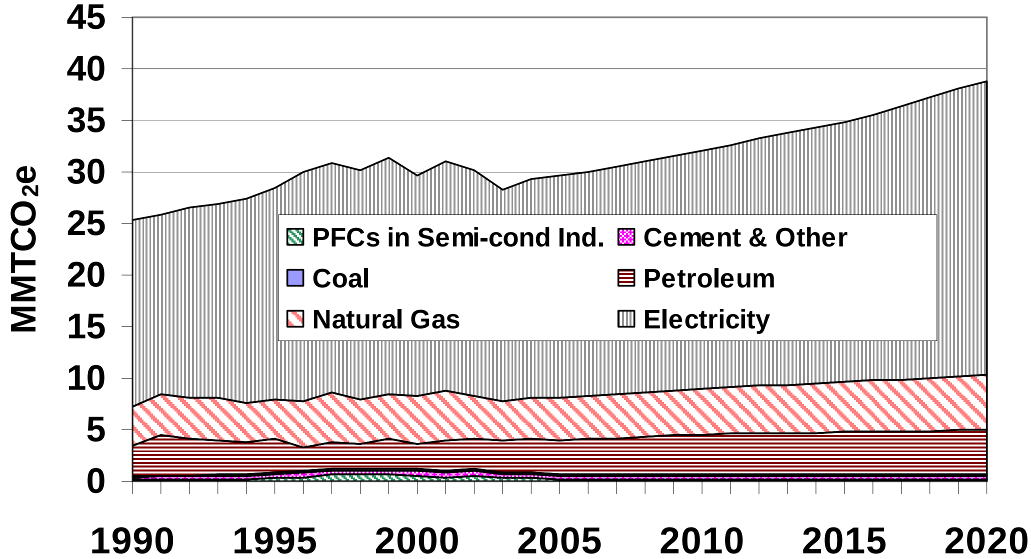
[1] We refer here to RCI as encompassing waste management activities and emissions.
[2] RCI fuel use accounted for 7.3 $MMtCO_2e$ in GHG emissions in 2000, while industrial process emissions, largely from cement production, the use of perfluorocarbons in the semi-conductor industry, the use of SF_6 by utilities, and the use of substitutes (such as HFCs) for ozone depleting substances accounted for 1.5 $MMtCO_2e$.
[3] Gross emissions here denote greenhouse gas emissions from activities in New Mexico, adjusted for exports of electricity, oil, and gas, but not including consideration of estimated "sinks" of greenhouse gases in the forestry and land-use sectors.
[4] The exception is process emissions from the semi-conductor industry, which are expected to decline significantly due to voluntary efforts.

Figure 0-1. Historical and Projected Residential Commercial and Industrial (RCI) Greenhouse Gas (GHG) Emissions in New Mexico, 1990 to 2020 (not including waste management)



PFCs – perfluorocarbons

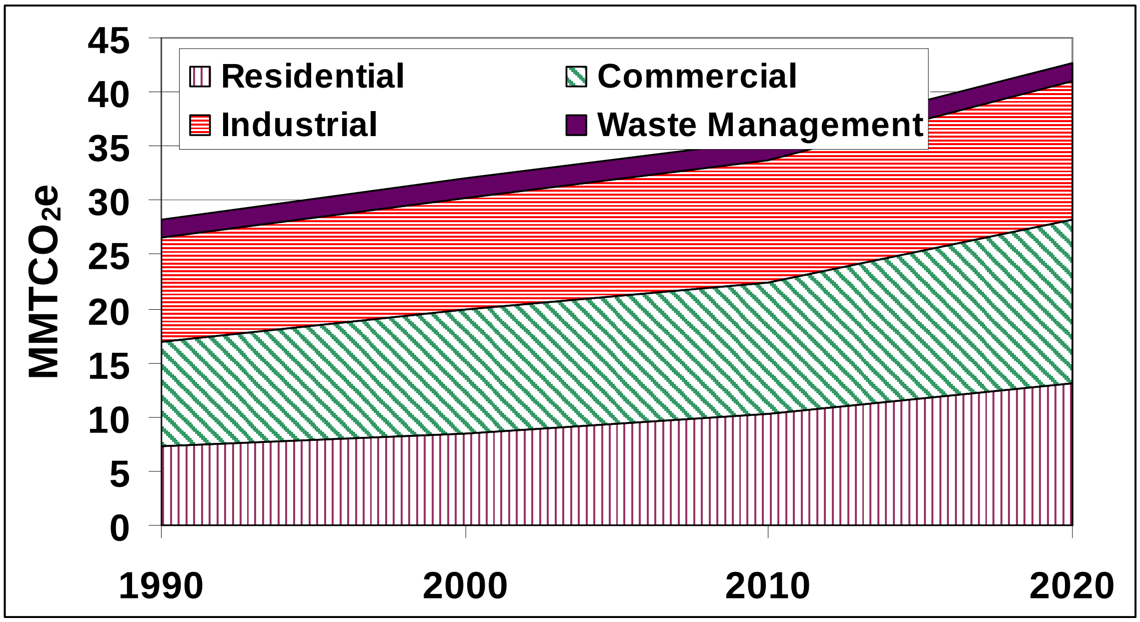
Table 4-1 shows estimated historical and projected emissions from management and treatment of solid wastes and wastewater from the RCI sectors. Emissions from waste management consist largely of methane leaking from landfills, while emissions from wastewater treatment include both methane and nitrous oxide. These emissions, in terms of carbon equivalents, are relatively minor compared to overall RCI emissions, yielding 2010 and 2020 estimated emissions equal to about 3% of RCI emissions.

Table 0-1. Summary of Estimated Historical and Projected Emissions from Waste and Wastewater Management in New Mexico

(Million Metric Tons CO_2 equivalent)	1990	2000	2010	2020
Waste Management	**0.8**	**1.2**	**1.4**	**1.2**
Solid Waste Management	0.6	1.0	1.1	0.9
Wastewater Management	0.2	0.2	0.3	0.3

Overall emissions associated with residential, commercial, and industrial activity have been similar across the three sectors. The combination of moderate population growth and increasing commercial sector activity over the coming decades the residential and commercial sectors, together with relatively slow growth in emissions in the industrial sector in New Mexico, means that the residential and commercial sectors will account for a larger share of emissions in 2020, under business as usual conditions, relative to their shares in 2000. Manufacturing activity is expected to continue to grow at a rate of about 2.1% per year, though this growth is likely to be offset by continuing declines in overall energy intensity due to energy efficiency gains and structural shifts to less energy-intensive industries.[5]

Figure 0-2. 1990-2020 GHG Emissions by Source



Key Challenges and Opportunities

The principal means to reduce RCI emissions include improving energy efficiency, substituting electricity and natural gas with lower-emission energy resources (such as, solar water heating and biofuels), more aggressive recycling and waste reduction programs and various strategies to decrease the emissions associated with electricity production (see Energy Supply). The state's relatively limited pursuit of energy efficiency until recent years offers strong opportunities to reduce emissions through programs and initiatives to improve the efficiency of buildings, appliances, and industrial practices. At the same time, New Mexico's relatively strong population growth, and the stated commitments of New Mexico's leaders to carry out significant emissions reductions, places pressure on communities and businesses to make swift decisions. A key challenge lies in the design and implementation of strategies that address State goals and thus ensure new buildings and industries take full advantage of opportunities to reduce energy use and emissions.

[5] Projections of manufacturing and non-manufacturing activity (employment growth) are based on estimates from the New Mexico Department of Labor. Declines in energy intensity are based on projections by the U.S. Department of Energy (Annual Energy Outlook 2005).

New Mexico has already taken important steps in this direction. Efficient Use of Energy Act (SB 644), signed into law in 2005, directs public electric and gas utilities to develop, fund and implement comprehensive, cost-effective energy efficiency programs. In 2002, the New Mexico Public Regulation Commission (NMPRC) unanimously approved a rule that requires utilities to offer a voluntary renewable energy tariff (green pricing option for customers). While an indication of the growing momentum for improving efficiency and reducing emissions, these actions only begin to tap the overall potential of the state to slow its growth of energy use and GHG emissions.

Overview of Policy Recommendations and Estimated Impacts

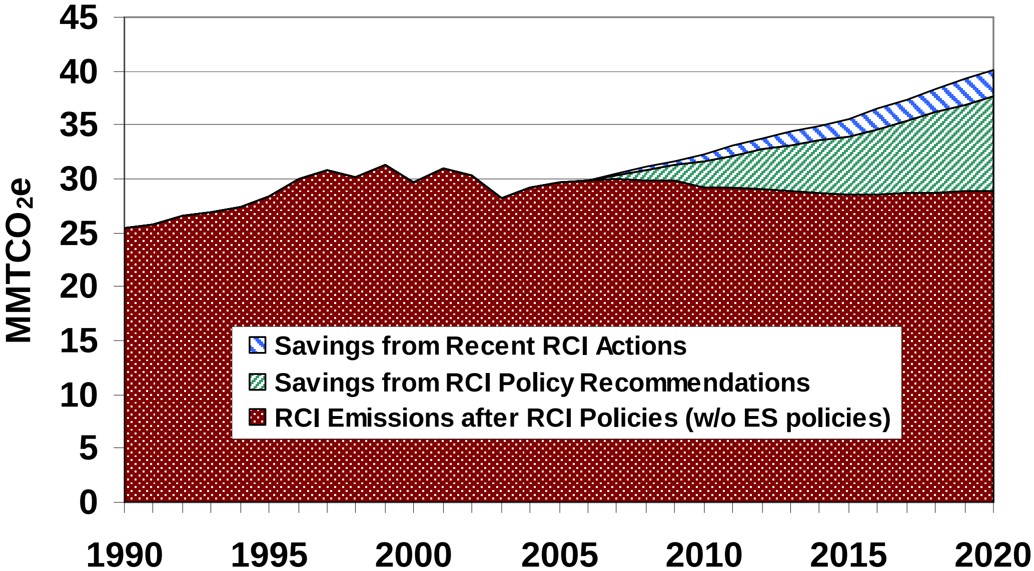
The CCAG recommends a set of 21 policy options for the residential, commercial, and industrial sectors (including waste management) that offer the potential for major economic benefits and emissions savings. As summarized in Figure 4-3, these policy recommendations could lead to emissions savings from reference case projections of 7 MMtCO_2e per year by 2020, cumulative savings of over 47 MMtCO_2e from 2006 through 2020.[6] They could result in net cost savings of over $630 million through the year 2020 on a net present value basis (NPV).[7] Most emissions savings from the RCI options are in the form of reduced carbon dioxide emissions, with relatively minor reductions of emissions of other greenhouse gases (principally methane and nitrous oxide) produced via leakage and/or combustion of fuels.

The estimated impacts of the RCI and solid waste policy recommended by the CCAG are shown in Table 4-2. Also shown in Table 4-2 are the results of several policies that have either been recently implemented or will be implemented as a result of earlier State policies. These "Savings from Recent RCI Actions" are not accounted for in the reference inventory and forecast, but contribute to overall emissions reduction along with savings from the CCAG-recommended measures. The combination of savings from recent actions and CCAG policies are, in the RCI sectors, estimated to be slightly greater than the projected reference case growth in emissions from 2006 through 2020, as shown by the trend in the dark area in Figure 4-3.

[6] Note that these figures do not include additional emission savings from recent actions not included in the reference case forecast. Note also that the emissions savings and costs of a number of the policy recommendations were not quantified. See the Appendix G for more detailed information. Of the total 47 MMtCO_2e in cumulative emissions savings from the RCI policies, 29 MMtCO_2e are from reduced electricity consumption, 9 MMtCO_2e are from the reduction in on-site use of fossil fuels, and 8 MMtCO_2e are from solid waste management (total differs due to rounding).

[7] The net cost savings are based on fuel expenditures, operations, maintenance, and administrative costs, and amortized, incremental equipment costs. All NPV analyses here use a 5% per year real discount rate.

Figure 0-3. Impact of Policy Recommendations on RCI Emissions



The CCAG policy recommendations described briefly here, and in more detail in Appendix G, result not only in significant emissions and costs savings, but offer a host of additional benefits as well. These benefits include – but are by no means limited to – reduction in spending on energy by homeowners and businesses, contributions to local economic development, reduced local air pollution, and improvements in comfort, convenience and indoor air quality as a result of building improvement measures.

In order for the RCI policy options recommended by the CCAG to yield the levels of savings described here, the options must be implemented in a timely, aggressive, and thorough manner. This means, for example, not only putting the policies themselves in place, but also attending to the development of "supporting policies" that are needed to help make the recommended options effective. Many of these supporting policies are a part of the package of RCI options and many are included among the policies recommended as "cross-cutting" policies (see Chapter 3). Improved building codes (RCI-7A through RCI-7C) will not be optimally effective, for example, without training of contractors, builders, architects, financial institutions, and building inspectors, among others, in the methods and benefits of efficient building design (as recommended in RCI-10). Regulatory policies that provide incentives and lower disincentives for the adoption of consumer-sited combined heat and power and renewable electricity generation are also among the supporting policies crucial to the success of the RCI options recommended by the CCAG; some of these policies are already in the formative stages (or beyond) in New Mexico. The CCAG's work indicates that there are considerable benefits to both the environment and to consumers from adoption of the policy options offered, but careful, comprehensive, and detailed planning and implementation, as well as consistent support, of these policies will be required if these benefits are to be achieved.

Table 0-2. CCAG Recommended Policy Options and Results for Residential, Commercial, Industrial (RCI) and Waste Management

	Policy Option	GHG Reductions ($MMtCO_2e$) 2012	2020	Total 2007-2020	Net Present Value 2007–2020 (Million $)	Cost-Effective-ness ($\$/tCO_2e$)	Level of Support
	RESIDENTIAL, COMMERCIAL AND INDUSTRIAL						
RCI-1	Demand Side Management (DSM) Programs, Energy Efficiency Funds,and/or Energy Efficiency Requirements for Electricity	0.2	1.0	5.5	-$98	-$18	UC
RCI-2	Demand Side Management (DSM) Programs, Energy Efficiency Funds, and/or Energy Efficiency Requirements for Natural Gas and Other Fuels	0.03	0.2	1.0	-$55	-$55	UC
RCI-3	Regional Market Transformation Alliance	0.1	0.5	2.9	-$79	-$27	UC
RCI-4	State Appliance Standards	0.1	0.3	2.1	-$97	-$46	UC
RCI-5	Green Power Purchasing	0.3	0.1	2.3	$15	$7	UC
RCI-6	Rate Design (Including Time of Use Rates, Increasing Block Rates, and Seasonal Use Rates)	0.3	0.3	3.6	-$141	-$40	UC
RCI-7A	Improved Building Codes	0.9	2.4	16.6	-$200	-$12	UC
RCI-7B	Solar Hot Water-ready and Solar-PV-ready Codes for New Buildings	*Not quantified*					UC
RCI-7C	Solar Hot Water Systems as an Element of Building Codes for New Buildings	*Not quantified*					UC
RCI-8A	Building Energy Performance Requirements for State-funded and Other Government Buildings ("Reach Codes")	0.01	0.04	0.2	0.2	$1	UC
RCI-8B	Building Energy Performance Promotion and Incentives for Energy Performance Enhancements (Attaining "Reach Codes") in Non-Government Buildings (Including Existing Buildings)	0.3	1.3	7.4	-$16	-$2	UC
RCI-9	Government Agency Requirements and Goals (including procurement) -- Focus on operations	0.04	0.2	0.9	-$18	-$20	UC
RCI-10	Education and Outreach for Building Professionals	*Not quantified*					UC
RCI-11	Consumer Education Programs	*Not quantified Jointly considered with CC TWG*					UC
RCI-12	Increased Emphasis on Energy and Environmental Consideration in Higher Education	*Not quantified Jointly considered with CC TWG*					UC
RCI-13	Incentives and Promotion for Renewable Energy and Clean Combined Heat and Power	*Jointly considered with Energy Supply TWG*					UC
RCI-14	Regulatory/Legislative Grid, Pricing, and other Policies to Support Distributed Generation	*Jointly considered with Energy Supply TWG*					UC

	Policy Option	GHG Reductions ($MMtCO_2e$) 2012	2020	Total 2007-2020	Net Present Value 2007–2020 (Million $)	Cost-Effective-ness ($/tCO_2e$)	Level of Support
RCI-16	Participation in Regional (or National) Industry Emissions Cap and Trade Programs	*Jointly considered with Energy Supply TWG*					UC
RCI-17	Voluntary Emissions Targets	0.3	0.7	4.6	*Not quantified*		UC
RCI-18	Use of Alternative Gases (Non-Energy Emissions, Indus. Process Gases)	*Not quantified*					UC
RCI-19	Solid Waste Recycling, Source Reduction, and Composting						
	Scenario A: Financial/Technical Support	0.2	0.5	3.6	*Not quantified*		UC
	Scenario B: Financial/Technical Support and Mandatory Recycling	0.5	1.1	8.4	*Not quantified*		UC
	SECTOR TOTAL AFTER ADJUSTING FOR OVERLAPS	2.6	6.8	47.2	-630	-18	
	REDUCTIONS FROM RECENT POLICY ACTIONS (see table below)	1.1	2.6	18.8			
	SECTOR TOTAL PLUS RECENT POLICY ACTIONS	3.7	9.4	66.0	-630	-18	

Emissions Reductions Associated with Recently Enacted Policies (and not included in baseline projections) that Are Related (*) to RCI Policy Options

Option Number	Policy Name	Estimated 2012 GHG Reduction ($MMtCO_2e$)	Estimated 2020 GHG Reduction ($MMtCO_2e$)	Cumulative 2007-2020 GHG Reduction ($MMtCO_2e$)
RCI-1*	Electricity DSM: Spending 1.5% of revenues as allowed by Efficient Use of Energy Act	0.7	1.7	12.4
RCI-2*	Natural Gas DSM: Spending 1.5% of revenues as allowed by Efficient Use of Energy Act	0.2	0.6	4.0
RCI-7A*	Improved Building Codes: "Current Activities", Estimated as Part of Western Governors Association Energy Efficiency Task Force Work	0.1	0.3	2.4

Residential, Commercial, Industrial (RCI) Policy Descriptions

The Residential, Commercial, Industrial Sectors include emissions reduction opportunities related to improving energy (and sometimes water) use efficiency, using lower GHG energy sources, and enhancing waste management practices.

RCI–1: Demand Side Management (DSM) Programs, Energy Efficiency Funds, and/or Energy Efficiency Requirements for Electricity

The CCAG recommends that New Mexico increase the efficiency of electricity use in New Mexico by increasing investment in demand-side management programs through programs run by utilities or others, energy efficiency funds, and/or energy efficiency requirements. This option focuses on what are typically termed DSM activities, and is designed to work in tandem with other strategies recommended by the CCAG that can also encourage efficiency gains.

The policy design includes two key and linked dimensions: achievable/desirable energy savings and policy/administrative mechanisms to achieve these savings. It is recommended that investment in electricity efficiency programs rise to the level needed capture the state's full, achievable energy efficiency potential, which is currently estimated to be an approximately 1.0% reduction in total electricity demand each year (relative to baseline levels). This savings level is consistent with the findings and recommendations of the Western Governors' Association Energy Efficiency Task Force, and can be achieved by increasing investment in cost-effective energy efficiency to the level of about 3% of utility revenues (that is receipts from customer bills) by 2012. This spending level exceeds the base level 1.5% of utility revenues currently allowed under the recent Efficient Use of Energy Act.

In order to implement expanded DSM programs, the CCAG recommends that a number of mechanisms be considered. Candidate mechanisms include revising existing statutes to enable utility investments in energy efficiency at the levels indicated above, to consider as potentially eligible programs that are cost-effective taking into account the valuation of for CO_2 emissions. Policy and administrative mechanisms that might be applied include regulator-verified savings targets, public benefit charges, portfolio standards, "energy trusts", integrated resource planning, performance-based incentives, decoupling of rates and revenues, appropriate rate treatment for efficiency, and/or others. Note that it is not the intent to specify here how this policy might be implemented; the mechanisms above are offered only as options to be considered.

RCI-2: Demand Side Management (DSM) Programs, Energy Efficiency Funds, and/or Energy Efficiency Requirements for Natural Gas and Other Fuels

The CCAG recommends that New Mexico should increase the efficiency of natural gas and other fuel use in New Mexico through programs, funds, and/or requirements. The options for pursuing natural gas efficiency savings are similar in nature to those described for electricity efficiency in option RCI-1 above. As in RCI-1, two key and linked dimensions are achievable/desirable energy savings and policy/administrative mechanisms to achieve those savings. Under the recommended policy, investment in natural gas efficiency programs rises to the level needed capture the state's full, achievable energy efficiency potential , which is currently estimated to be an approximately a 1.16% reduction in total natural gas demand each year (relative to baseline levels). This savings level can be achieved by increasing investment in energy efficiency to the level of about 2.2% of gas utility revenues by 2012. This spending level exceeds the base level 1.5% of utility revenues currently allowed under the recent Efficient Use of Energy Act.

Implementation of this policy will require a combination of revising existing statutes to enable investment spending sufficient to reach savings goals, and to consider as potentially eligible programs that are cost-effective even taking into the valuation of CO_2 emissions. Additional policy and administrative mechanisms to be used might include regulator-verified savings targets, public benefit charges, portfolio standards, "energy trusts", integrated resource planning, performance-based incentives, decoupling of rates and revenues, appropriate rate treatment for efficiency, and/or others. These mechanisms above are offered as options to be considered.

RCI-3: Regional Market Transformation Alliance

The CCAG recommends that New Mexico work with other states in the region and non-governmental organizations to form a regional market transformation organization, modeled on the successful Northwest Energy Efficiency Alliance (NEEA), as recommended by the WGA CDEAC EE Task Force, and to pursue other regional efforts that use voluntary efforts implemented by non-utility organizations to encourage greater uptake by consumers (residential, commercial, and industrial, as well as the professionals that service energy-using equipment) of cost-effective energy conservation practices.

This organization would be a useful complement to the electricity and natural gas efficiency options RCI-1and RCI-2. Such an organization could focus on products and sectors (such as evaporative swamp coolers or formation of energy service companies) in a manner that could complement what utilities would otherwise be providing through their efficiency programs. It is recommended that the organization be set up by 2008, and fully implemented by 2010

RCI-4: State Appliance Standards

The CCAG recommends that New Mexico should adopt more stringent appliance efficiency standards. Appliance efficiency standards reduce the market cost of energy efficiency improvements by incorporating technological advances into base appliance models, thereby creating economies of scale. This policy option involves the replication of standards first adopted in nearby states (such as California) for appliances not covered by federal standards. It also involves the State, together with other Western states, advocating for stronger federal appliance efficiency standards where this is technically feasible and economically justified. New standards should come into force in 2007/2008 for standards already implemented by nearby states, and following by 6 months to 1 year future adoption in nearby states of standards for additional appliance/equipment and/or more stringent energy-efficiency requirements for appliances and equipment now included in standards.

RCI-5: Green Power Purchasing

The CCAG recommends that New Mexico should expand implement and promote its green power purchasing. This option comprises a variety of consumer-driven strategies to increase the production and delivery of low-GHG power sources, above and beyond levels achieved through Renewable Portfolio Standards and other mandatory programs. Green power, as defined here, includes power from renewable energy technologies recognized by the state Renewable Portfolio Standard.

This policy involves the following components:

- The Public Regulatory Commission (PRC) should consider adopting and encouraging utilities to develop green power tariff structures that a) enable "quantity savings" for large purchases. (such as Pacificorp's Blue Sky QS program) ; b) are stable thus avoiding the volatility associated with standard rates due to fluctuating gas or other fuel prices (such as Austin Energy's program); and c) are based on cost-of-service principles.
- The PRC would also provide for the reporting power sources and emissions data in consumer bills.
- The State should set a goal that, by 2010, a minimum total of 30% of electricity should come from green power purchases or the renewable fraction of standard purchased electricity, possibly modeled on the federal purchasing requirements in EPACT 2005. This goal would apply to all non-federal government buildings, including local government, public schools, and public universities.
- The State and other entities should also promote voluntary purchasing of green power (through provision of information and promotional materials).

The CCAG recommends that this policy start in 2010, with goals reviewed every 5 years. The CCAG suggests that programs and goals for local governments might be phased in more slowly than for state government power purchasers.

RCI-6: Rate Design (Including Time of Use Rates, Increasing Block Rates, and Seasonal Use Rates)

The CCAG recommends that New Mexico utilities should propose, and the state regulatory commission should adopt, rate designs that promote reduction in GHG emissions and/or improvements in energy efficiency. This option includes reducing customer charges, discouraging existing decreasing block rates, pursuing peak season surcharge rates, and encouraging the use of steep increasing block rates for appropriate customer classes as a means reducing GHG emissions through promotion of energy efficiency.   It will be important to consider interaction with potential efforts to decouple utility revenues from levels of sales (see RCI-1 and RCI-2), and to ensure that higher marginal electricity costs do not lead consumers to switch to other, more GHG-intensive energy.

RCI-7A: Improved Building Codes

The CCAG recommends that New Mexico should upgrade the energy-efficiency provisions of its building codes. Building energy codes specify minimum energy efficiency requirements for new buildings or for existing buildings undergoing a major renovation. As energy use (largely electricity and gas) in buildings in New Mexico accounts for about 36 percent of current emissions, amending the existing New Mexico Building Codes will have a considerable immediate impact towards the reduction of greenhouse gas emissions. An ongoing process of code amendments for new and renovated residential and commercial buildings is recommended by the CCAG, and includes the following aspects:

- Building codes will be amended to reduce the building energy needs in areas including but not limited to HVAC systems, daylighting design to reduce lighting needs, electric lighting design, building envelope design, using integrated building design strategies.
- New Mexico should update its energy codes regularly. A three-year cycle could be timed to coincide with release of national model codes. Local adoption of new statewide codes should occur within 6 months of statewide code adoption.
- New Mexico should adopt innovative features building energy codes in other states that go beyond the IECC codes in force, as appropriate to conditions in New Mexico.
- To mitigate the problem of rapid growth in the number of homes using energy intensive, compressor-based cooling systems for central air conditioning (CAC) in lieu of the traditional evaporative cooler , building codes should include a combination of offsetting measures for any newly constructed or renovated home that includes CAC.
- By 2010, buildings in New Mexico should be required to consume 50 percent less energy per square foot than average US buildings, as reflected in the most recently available information on similar building types (on a climate-adjusted basis).
- Building professionals, including building inspectors, should be provided with training in the use of analytical and design tools that allow building energy performance to be estimated in the design phase, so that compliance with energy performance codes can be tested.
- After 2010, the required percentage improvement in energy performance should be reviewed every 3 years and updated through a combination of codes revision and legislative action based on consideration of new developments in building energy efficiency, national and international energy codes, New Mexico state targets for reduction of greenhouse gas emissions, and the overall goal that buildings be “carbon neutral” by 2030.
- New Mexico should join a regional “Building Energy Codes Collaborative”, as recommended by the WGA.

RCI-7B: Solar Hot Water-ready and Solar-PV-ready Codes for New Buildings

The CCAG recommends that New Mexico should modify building energy codes to require new residential buildings and new commercial buildings to be configured for, and to include plumbing and wiring for mounting and installation of, solar hot water heaters and solar photovoltaic (PV) panels.

Amending building energy codes to take advantage of the very good solar resource found in most of New Mexico, this policy would specify that all new buildings, as applicable, would be required to be built so as to accommodate systems for solar water heat, and would also be required to be built "solar PV ready", that is, designed to have solar PV systems mounted in an unobstructed location, and including wiring and other facilities for mounting and connecting solar PV systems to the building's electricity system and, as applicable, to the local power grid. These codes will apply to major renovations as well as new buildings, but exceptions to the "solar-ready" building code requirements may be granted when applicable. Solar-ready building code requirements should be implemented on the same schedule as the building energy codes revisions in RCI-7A.

RCI-7C: Solar Hot Water Systems as an Element of Building Codes for New Buildings

The CCAG recommends that New Mexico should modify building energy codes to require new residential buildings and new commercial buildings with substantial water heat demand to install solar water heaters. This requirement would apply to builders of speculative construction (buyer unknown) unless the builder can show that there is a more cost-effective option for providing hot water. Builders of non-speculative construction (buyer known) would be required to offer solar hot water to the prospective buyer, with the buyer making the choice of whether to have solar hot water installed.

Amending building energy codes to take advantage of the very good solar resource found in most of New Mexico, this policy would specify that all new buildings, and buildings undergoing major renovations, would, as applicable, and with appropriate exclusions, limitations, and alternatives, be required to implement solar water heat.

Solar hot water building code requirements should be implemented on the same schedule as the building energy codes revisions in RCI-7A.

RCI-8A: Building Energy Performance Requirements for State-funded and Other Government Buildings ("Reach Codes")

The CCAG recommends that the New Mexico State Government provide leadership in moving the State toward a stock of buildings with much higher energy efficiency by the example of requiring all new state- and state-funded government buildings to meet increasingly stringent energy performance and renewable energy use standards.

New Mexico sets as its goal that all buildings be "carbon neutral" by 2030, meaning that any energy needs in a building, net of efficiency gains through building design to reduce energy use and of on-site renewable energy use, should be supplied by renewable energy sources ("green power"). The CCAG recommends that building energy performance standards should be implemented in State-funded government buildings, including the Higher Education Department, such that new buildings achieve high standards of energy efficiency, and existing buildings are retrofitted to yield significant energy efficiency improvements.

Specifically, it is recommended:

- That all State-funded new buildings and building renovation projects of 5,000 square feet and above and/or using over 50 kW electrical demand are mandated to build to a minimum rating of "Silver" using the U.S. Green Building Council's LEED-NC™, LEED-EB™, LEED-CS™, or LEED-CI™ rating system - or verifiable equivalent - in effect as of the project registration date by 2007.

- In addition to achieving one of the ratings above, or their equivalent, state-funded buildings and building renovations must achieve at least an 50% reduction in energy use on a weather-normalized per-square-foot basis relative to average buildings of the same type in the US, as determined by modeling . Additionally, requirements for the minimum delivered fossil fuel energy consumption performance standard shall be increased to 60% reduction in 2010; 70% in 2015; 80% in 2020; 90% in 2025 and to "carbon neutral" (as defined above) in 2030. No more than 25% of the building's reduction goal may be met through the use of off-site green power. These requirements would be reviewed every three years.
- Modify the State procurement processes to facilitate reaching the requirements above.
- Whenever possible, design and build State-funded and other Government buildings incorporating features designed not only to reduce energy use within the buildings, but to reduce energy use in the surrounding community through incorporation of considerations of transport access, the availability of necessary commercial services, and other aspects of community life that affect energy use.
- Carry out starting in 2007, and completed by 2010, a program to audit energy use and energy efficiency opportunities in State buildings.

RCI-8B: Building Energy Performance Promotion and Incentives for Energy Performance Enhancements (Attaining "Reach Codes") in Non-Government Buildings (Including Existing Buildings)

The CCAG recommends that energy efficiency in existing buildings and in non-government-funded new buildings in New Mexico should be substantially improved, and use of renewable energy expanded, through a combination of financial incentives, education and information resources, and technical assistance. The CCAG recommends that New Mexico should develop policies and programs to promote and implement in new and existing non-State public and private buildings, on a voluntary basis, energy "reach codes". "Reach codes" are higher-than-prevailing-code energy performance levels for buildings, which are suggested to be mandated for state-owned and state-funded buildings under Policy Option RCI-8A, above. Specifically, it is recommended to:

- Create a "high performance buildings" initiative that provides incentives, technical support, and other assistance to induce private developers of commercial new buildings and building renovation projects to meet the same requirements of proposed policy 8A, above.
- Include a residential program in the "high performance buildings" initiative that provides incentives for private developers, including designers, developers, and builders of residential and manufactured housing. The program requirements would have the same energy goals as those for commercial buildings.
- Provide incentives for the undertaking of substantial building energy efficiency measures and retrofits in existing buildings (including manufactured housing).
- Provide incentives and other support to encourage non-government buildings to be designed and built, and, where applicable, retrofitted, so as to incorporate features designed not only to reduce energy use within the buildings, but to reduce energy use in the surrounding community.

- Provide incentives and other support to encourage residential and commercial-sector consumers to switch to the use of less carbon-intensive fuels to provide key energy services.

RCI-9: Government Agency Requirements and Goals (including procurement) -- Focus on Operations

The CCAG recommends that New Mexico should improve the efficiency of energy use in existing government buildings and other facilities by emphasizing energy efficiency as a criterion in procurement of energy-using equipment and systems, and in the improvement in operation of buildings and other facilities. Municipal Energy Management systems and initiatives, as well as audits of energy performance and operations of State and other government buildings (in tandem with the audit program proposed in RCI-8A), are included as elements of this policy. Audit results will be used to target and prioritize investments in improving government building energy efficiency. It is recommended that the infrastructure for implementation (meters, bookkeeping systems, staff, etc.) be established as soon as possible so as to be able to report results in 2009, and implement improvements starting in 2010.

RCI-10: Education and Outreach for Building Professionals

The CCAG recommends that New Mexico should require specific and targeted education, outreach, and licensing requirements for professionals in a variety of building-related trades. The building code improvement and building energy efficiency options described above depend for their effectiveness on the availability of trained, committed design, construction, and operations professionals to make sure that buildings are designed, constructed, and run so as to make those buildings as energy-efficient as possible within the restrictions of their function. The CCAG finds that a combination of education of and outreach to building professionals is needed to make sure that as many of those professionals as possible incorporate energy-efficiency and greenhouse gas emissions-reduction considerations as they do their jobs. Specifically, it is recommended that:

- Mandate that State Boards of Licensing for building professionals cover in licensing exams knowledge of the improved building codes and building energy performance requirements reflected in policy options RCI-7A, -7B, and -7C, as well as RCI-8A and RCI-8B.
- Implement code training and technical assistance for architects, builders, and local code inspectors.
- Implement programs to train builders and contractors on proper heating and air conditioning sizing and installation.
- Train commercial building energy managers, for example by making use of the building operator training and certification program developed in the Pacific Northwest.
- Train industrial energy and facility managers in techniques for improving the efficiency of their steam, process heat, pumping, compressed air, motors, and other systems, partnering with the U.S. DOE in doing so.
- As appropriate and applicable for each professional discipline, include training and outreach to encourage design of energy-efficient communities.
- The implementation of these actions should be timed as required to support other buildings-related policies recommended by the CCAG.

RCI-11: Consumer Education Programs, and RCI-12: Increased Emphasis on Energy and Environmental Consideration in Higher Education (option shared with CC-3)

The CCAG recommends that New Mexico lead by example in its own education and outreach activities by establishing a pro-active public education and outreach capability, and using it to target education and outreach activities to five specific audiences:

- Policymakers (legislators, regulators, executive branch, agencies) – because implementation of climate actions hinges on policymakers' approval.
- Younger Generations – by integrating climate change into educational curricula, post-secondary degree programs, and professional licensing programs.
- Community Leaders & Community-Based Organizations (e.g., institutions, municipalities, service clubs, social & affinity groups, non-governmental organizations, etc.) – in order to recognize leadership; share success stories and role models; and expand climate involvement and participation within civic society.
- General Public – to increase awareness and engage citizens in climate actions in their personal and professional lives.
- Industrial and Economic Sectors – in order to recognize leadership; share success stories and role models; and expand climate involvement and participation within the business community.

Specific public education and outreach efforts suggested for these policies are provided in Appendix F under "CC-3 State Climate Public Education and Outreach".

RCI-13: Incentives and Promotion for Renewable Energy and Clean Combined Heat and Power

The CCAG supports this option, as addressed by the Energy Supply options ES-2, ES-4, and ES-8.

RCI-14: Regulatory/Legislative Grid, Pricing, and other Policies to Support Distributed Generation

The CCAG supports this option, as addressed by the Energy Supply options ES-2, ES-4, and ES-8.

RCI-16: Participation in Regional (or National) Industry Emissions Cap and Trade Programs

The CCAG supports this option, as addressed by the Energy Supply option ES-14.

RCI-17: Voluntary Emissions Targets

The CCAG recommends that New Mexico should work with industrial and other large users of energy (and/or of process gases that are greenhouse gases) to encourage those organizations to set emissions reduction targets. Fuel-switching, where applicable, may be used as a means of emissions reduction. This recommendation may be implemented through a combination of financial and other incentives, public-private partnerships and agreements, provision of information and technical assistance, and other methods.

Reductions in greenhouse gas emissions can be achieved in the industrial sector through energy efficiency, process changes, and/or switching to the use of less carbon-intensive fuels to provide key energy services. Fuel switching opportunities can include using natural gas in the place of electricity for thermal end-uses, natural gas in the place of coal for key industrial end-uses, biomass fuels in the place of electricity or natural gas for thermal end-uses, and solar thermal energy in the place of electricity or natural gas for thermal end-uses. As a goal for this option, industrial sector entities (other than fossil fuel industries) would be encouraged to establish and meet emission goals that meet or exceed the overall state goal for reduction of GHG emissions (that is, return to 2000 emission levels by 2012, and move to 10% below 2000 levels by 2020).

RCI-18: Use of Alternative Gases (Non-Energy Emissions, Industrial Process Gases)

The CCAG recommends that New Mexico should reduce HFC emissions through leakage management efforts and the substitution of HFCs with lower-GWP refrigerants, including lower-GWP HFCs, carbon dioxide, and hydrocarbons (HCs - propane or isobutene/propane blend).

Many of these opportunities lie in the transportation sector (mobile air conditioning). For the RCI sector, the adoption of specifications for new commercial refrigeration is recommended. These specifications could limit the global warming potential of refrigerants used in refrigerators in retail food stores, restaurants, and refrigerated transport vehicles (trucks and railcars) and/or require that centralized systems with large refrigerant charges and long distribution lines be avoided in favor of systems that use much less refrigerant and lack long distribution lines. Another suggestion for implementation of this policy is that the state could “lead by example” by implementing such improvements in relevant state facilities. In addition, the State should continue to monitor and review approaches that the Federal Government and other jurisdictions are taking toward the regulation of HFCs and similar substances, including consideration of whether the use and emissions of HFCs can be regulated under the laws of the State of New Mexico.

RCI-19: Solid Waste Recycling, Source Reduction, and Composting

The CCAG recommends that New Mexico undertake efforts to increase recycling, composting and other waste management activities. Legislative efforts to require recycling by businesses and individuals and/or to provide grant and staffing support to the Solid Waste Bureau may be essential to significantly increase the state recycling rate, which is currently 3%. This rate falls well short of the state’s recycling (diversion) goals. The current manpower and financial tools available to the Solid Waste Bureau are insufficient to achieve significant improvements. Several states and municipalities have used mandatory recycling as a means to achieve more ambitious recycling goals.

In terms of financial and technical support to recycling programs, it is recommended that the NM legislature provide: a) an adequate budget recharge to the Solid Waste Facility Grant Fund (to support a range of solid waste activities and investments); b) appropriations for a grant/loan program to be used for hazardous, e-waste, recycling and diversion programs; c) expanding (to previous levels) SWB staffing to provide more technical assistance/consulting into the field.

To achieve a more significant change in New Mexico's recycling rate, the state Solid Waste Act would likely need to be amended to enable local governments to implement mandatory recycling programs. Any mandated program would need to ensure adequate funding and access to markets for recycled materials.

Chapter 5
Energy Supply

Overview of GHG Emissions

GHG emissions from the Energy Supply (ES) sector in New Mexico include emissions from electricity generation and the fossil fuel industry (i.e., oil, natural gas, and coal) and comprise a substantial majority of the State's overall GHG emissions (approximately 64% of gross emissions in 2000). New Mexico GHG emissions are proportionally greater than many states because New Mexico is an energy exporter, of both electric and fossil fuel energy. Roughly two-thirds of the State's fossil fuel emissions are associated with exports. Slightly less than half of New Mexico's electric generation emissions are associated with exports, though this is expected to decline to less than one-third by 2020 based on the CCAG reference case forecast. Overall, by 2020 Energy Supply emissions are expected to increase from 1990 levels by approximately 32% on a production basis with the fossil fuel industry somewhat outpacing electric generation in increased GHG emissions due to increasing demand for natural gas. Due to continued growth in the State, emissions reflecting energy consumed in New Mexico (rather than exported to other states) are anticipated to rise approximately 63% over 1990 levels by 2020, with electric generation emissions increasing more than fossil fuel emissions.

Figure 5-1 Historical and Projected GHG Emissions from the Electric Sector, New Mexico, 1990 to 2020 (Consumption Basis)

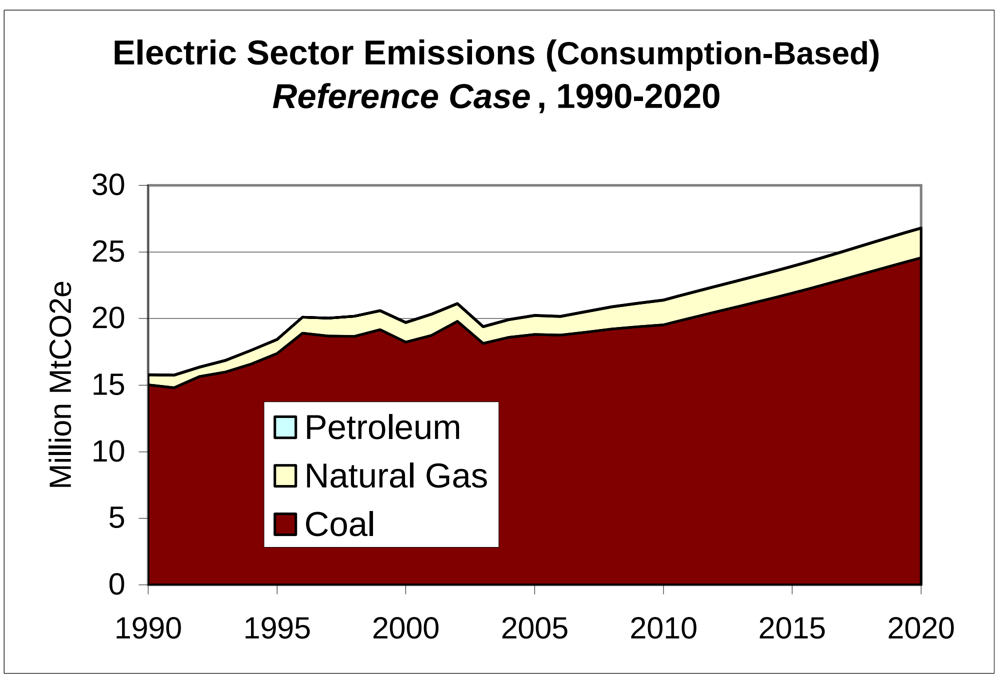
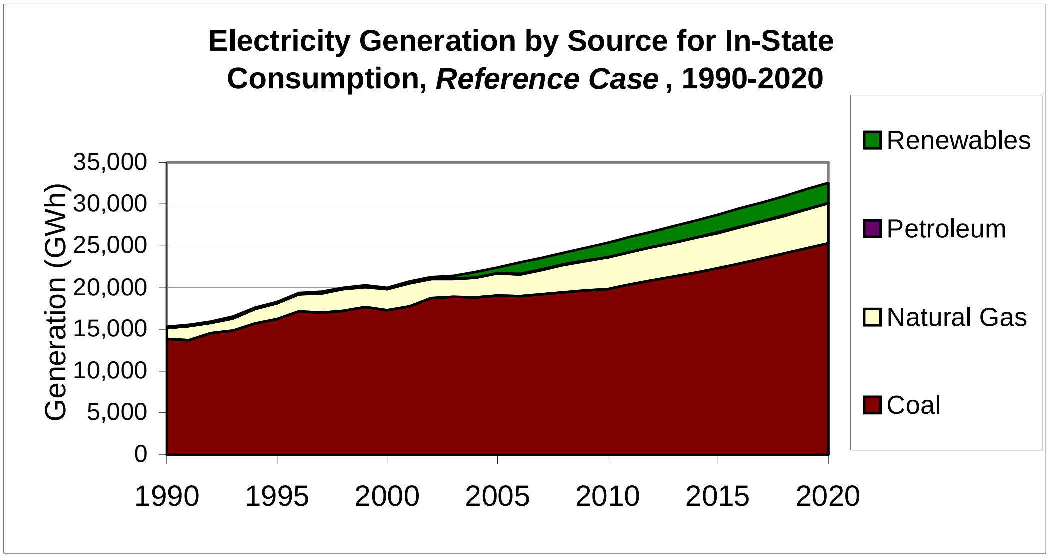


Figure 5-2 Historical and Projected Electricity Generation, New Mexico, 1990 to 2020 (Consumption Basis)



Key Challenges and Opportunities

There are two primary challenges in addressing GHG emissions from New Mexico's Energy Supply sector: continued growth within the State and ever-higher demand from other states for New Mexico's energy products. These challenges are compounded by significant uncertainties, including whether natural gas production in the State will remain relatively flat through 2020 due to intensified exploration efforts and unconventional recovery techniques, or whether it will decline as natural gas fields in the State are tapped out. A second key uncertainty is associated with increasing electricity consumption: Will New Mexico simply reduce power exports in order to meet its growing domestic need, or will it retain its presence as a major energy exporter by bringing new electric generating facilities on line? New Mexico may face an additional challenge in reducing GHG emissions from the power sector because generating facilities in the State are subject to substantially different oversight regimes depending on whether they are regulated by the Public Regulation Commission (e.g., PNM), overseen by their own elected board (e.g., rural electric cooperatives), or are located on tribal lands (e.g., the Four Corners Power Plant). This disparity may make broad adoption of some of the CCAG's recommendations more difficult. In order to facilitate calculations and provide a complete statewide picture, quantification of costs and GHG reductions for ES measures includes tribally operated facilities and electric cooperatives.

Fortunately, there are significant opportunities to reduce GHG emissions growth attributable to energy production and supply, including diminishing the carbon intensity of electrical generation through greater use of renewable energy options and recapture of waste energy through combined heat and power and other technologies. Where actions are both technically and economically feasible, natural gas producers and processors can benefit from the fact that steps which reduce methane venting, leaks, or combustion – of which there are many – enable more product to come to the market, producing a genuine win-win situation. Significant opportunities to reduce GHG emissions through policies addressing electricity consumption also exist and can often provide cost savings. The CCAG has identified several demand-side management, energy efficiency, and conservation measures in the Residential, Commercial, and Industrial Sector; these are detailed in Chapter 4.

New Mexico has plentiful renewable resources in the form solar and wind energy, and due to the State's long history as an energy pioneer, unusual human resources to capitalize on these resources. This offers the State a significant leadership opportunity in the commercialization of associated technologies. New Mexico also has untapped wind resources, albeit not necessarily well located to meet domestic demand. Wind's intermittency inhibits its value for baseload capacity, but its value to the electricity grid can be enhanced by carefully planning wind facilities at multiple sites

Overview of Policy Recommendations and Estimated Impacts

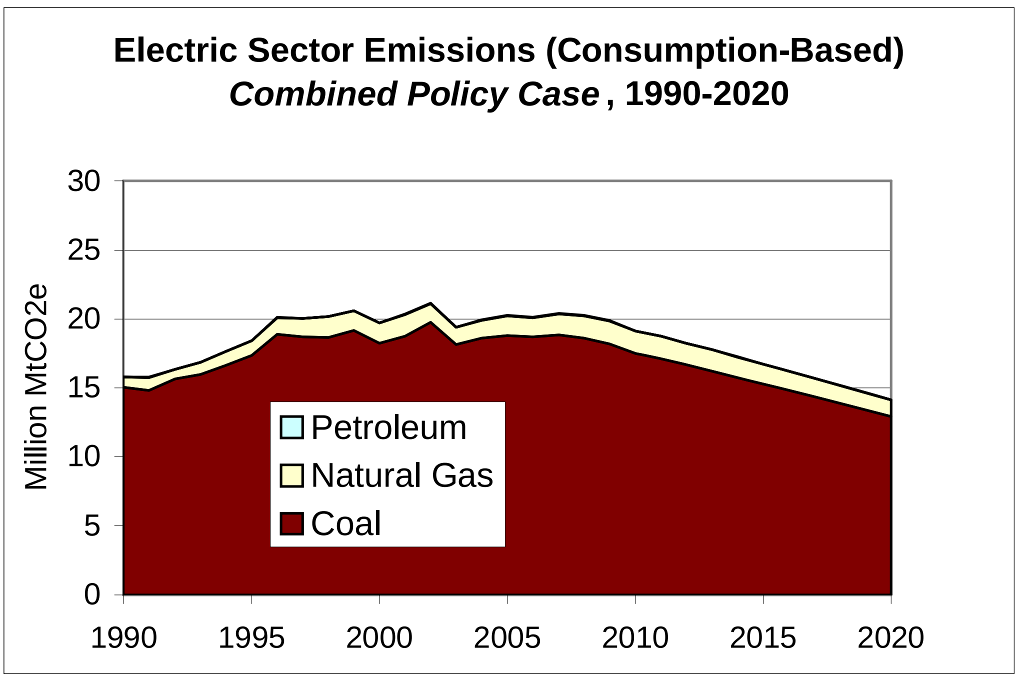
The CCAG recommends a set of 17 policy options for the Energy Supply sector that offer the potential for significant GHG emission reductions. These recommendations can be grouped into those affecting electricity supply (ES-1 through ES-10 and ES-14 through ES-16) and those affecting oil and gas operations (ES-11 through ES-13).

The electricity supply recommendations include efforts to increase the supply of renewable energy (ES-1B and C, 2, 4), encourage lower-emitting fossil fuel generation (ES-6), reduce the average emissions of new utility resource acquisitions (ES-15), increase distributed generation (ES-8) and reduce demand. A glance at the numbers in Table 5-1 would seem to suggest that if simply added together, cumulative emission reductions of these policies could exceed 100 MMtCO2 in 2020 and NPV costs could exceed $1 billion, assuming all options are implemented in isolation from each other. However, these options are <u>not</u> additive. In fact, they tend to overlap heavily, so simply adding them would introduce significant double-counting. These options essentially target – through different means – the avoidance of the same or similar emissions sources (e.g., the emissions from fossil-fuel power plants existing and yet to be built). When taken together in a combined scenario that assumes all of the CCAG's recommendations are fully implemented, these electricity supply recommendations are estimated to lead to cumulative GHG emissions reductions of about 39 MMtCO2e through 2020 at a cost of about $258 million. (See Appendix H for discussion of the methodology used for the integrated analysis.)

In fact, the CCAG's policy recommendations concerning GHG emissions from electric generation are highly interactive with its RCI policy recommendations that concern electricity use, because reducing electricity demand can offset the need for new generation, often at a lower cost or even with a savings. The scenario above (full implementation of all CCAG recommendations) takes into account the many overlaps among Energy Supply and RCI policy options that reduce the demand for power. Overall, the combined Energy Supply and RCI recommendations yield potential reductions in electricity sector emissions from reference case projections of 13 MMtCO_2e per year by 2020 and cumulative reductions of almost 83 MMtCO_2e from 2007 through 2020, at a net savings of approximately $128 million through the year 2020 on an NPV basis. These combined Energy Supply and RCI results are shown in Figures 5-3 and 5-4.[1]

As shown in Figure 5-5, the CCAG policy recommendations concerning GHG emissions from operations in the oil and gas industry could potentially reduce as much as 7.8 MMtCO_2e per year by 2020 and 71 MMtCO_2e from 2007 through 2020. Overall, the weighted average cost of carbon reductions from the Energy Supply policy options for which quantitative estimates of both costs and savings were prepared (which did not include oil and gas options[2]) was less than $7 per metric ton of CO_2 equivalent (after eliminating potentially overlapping options).

Figure 5-3 Impact of Policy Recommendations on Electric Sector Emissions



[1] The net cost savings are based on fuel expenditures, operations, maintenance, and administrative costs, and amortized, incremental equipment costs. All NPV analyses here use a 5% real discount rate.

[2] Quantification estimates for these options had not been approved by the CCAG at its conclusion. Initial cursory estimates may be found in Appendices H-5, H-6, H-7, and H-8.

Figure 5-4 Impact of Policy Recommendations on Electric Generation

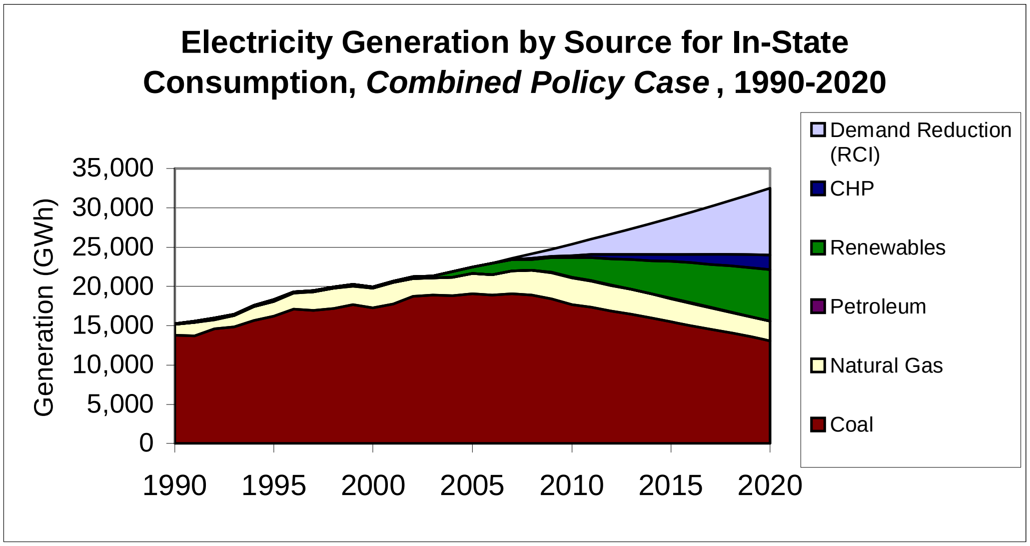
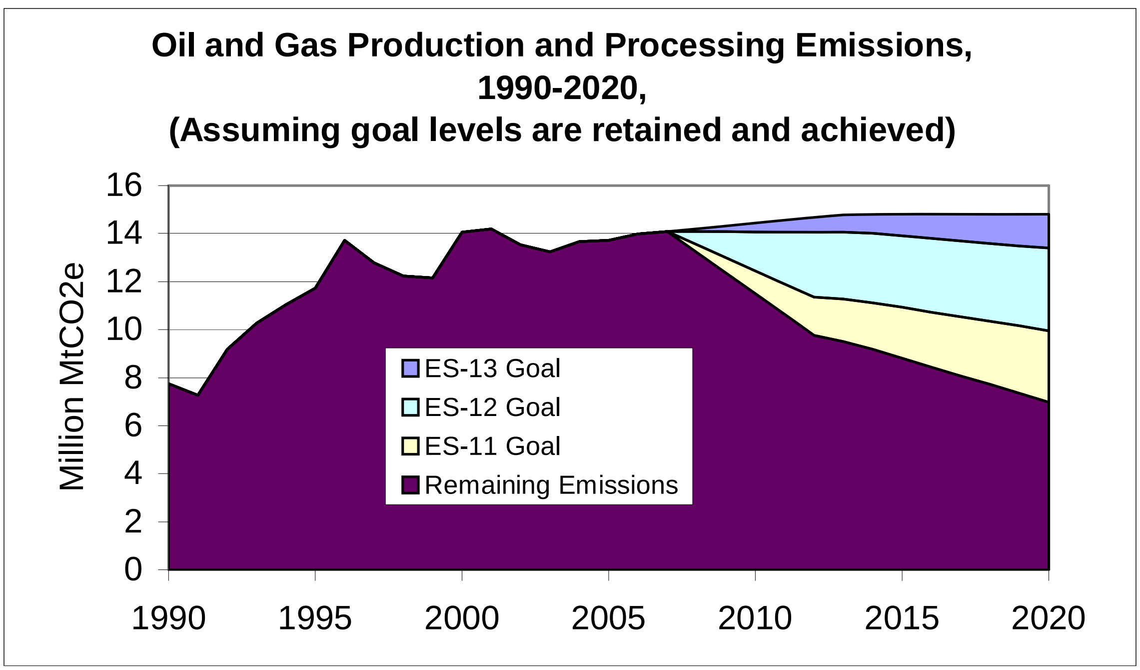


Figure 5-5 Historical and Projected GHG Emissions from Oil and Gas Production and Processing 1990 to 2020*



** Goal levels for ES-11, ES-12, and ES-13 may be modified following comprehensive technical and economic feasibility studies called for in these policy options.*

The estimated impacts of the recommended Energy Supply policies are shown in Table 5-1. The CCAG policy recommendations described briefly here (and in more detail in Appendix H to this Report) result not only in significant emissions savings, but offer significant additional benefits as well. A substantial expansion of renewable energy in New Mexico, for instance, may be accompanied by a corresponding increase in related jobs in New Mexico as energy investment shifts from fuel production to the manufacture of renewable technologies on a relative basis. Leadership in commercializing renewable technologies would also contribute to the growth and influence of New Mexico-based companies serving markets elsewhere. Energy reliability and security could be enhanced by greater penetration of distributed and renewable energy resources, as would public health and visibility as a function of reduced fossil fuel-fired emissions.

Table 5-1 CCAG Recommended Policy Options and Results for the Energy Supply Sector

	Policy Option	GHG Reductions ($MMtCO_2e$)			Net Present Value 2007–2020 (Million $)	Cost-Effective-ness ($/$tCO_2e$)	Level of Support
		2012	2020	Total 2007-2020			
	ENERGY SUPPLY						
ES-1	Mandate(s) for Renewable Energy (RPS, etc.)						
	Scenario B: 10% in 2011, 1% increase/year to 2021	1.1	2.6	17.8	$102	$6	UC
	Scenario C: 10% in 2011, 2% increase/year to 2021	*See ES-4 below*					Majority (9 Obj's)
ES-2	Financial Incentives for Distributed Renewables	0.02	0.4	1.6	$164	$105	UC
ES-3	Renewable Energy Transmission and Storage	*Not quantified*					UC
ES-4	RPS with Financial Incentives for Centralized Renewables	1.2	4.2	26.0	$215	$8	UC
ES-5	R&D including Energy Storage	*Not quantified*					UC
ES-6	Advanced Coal/Fossil Technologies (e.g., IGCC with carbon capture)	0.8	4.3	22.7	$650	$29	UC
ES-7	Nuclear Power	*Not quantified*					UC
ES-8	Incentives and Barrier Reductions for Combined Heat & Power (CHP)	0.3	0.9	6.1	$26	$4	UC
ES-9	Demand-Side Management, Energy Efficiency, and Integrated Resource Planning (IRP) [a]	*Jointly considered with RCI TWG (RCI-1)*					
ES-10	Transmission Capacity and Corridors	*Not quantified*					UC

	Policy Option	GHG Reductions ($MMtCO_2e$) 2012	2020	Total 2007-2020	Net Present Value 2007–2020 (Million $)	Cost-Effective-ness ($\$/tCO_2e$)	Level of Support
ES-11	**CO2 Capture and Storage or Reuse (CCSR) in Oil and Gas Operations [b]**	**1.6**	**3.0**	**25.1**	***Not quantified***		**UC**
ES-12	**Methane Reduction in Oil and Gas Operations: BMPs and PROs [b]**	**2.7**	**3.4**	**35.3**	***Not quantified***		**UC**
ES-13	**CO2 Reduction from Fuel Combustion in Oil and Gas Operations [b]**	**0.6**	**1.4**	**10.6**	***Not quantified***		**UC**
ES-14	**GHG Cap and Trade**	***Not quantified***					**UC**
ES-15	**Generation Performance Standard**	**1.2**	**3.8**	**24.3**	**$522**	**$21**	**Majority (9 Obj's)**
ES-16	**Clean Energy Development for Electric Cooperatives**	***Non-quantified enabling policy***					**UC**
	SECTOR TOTAL AFTER ADJUSTING FOR OVERLAPS	**6.7**	**14.3**	**109**	**$258**	**$7**	
	REDUCTIONS FROM RECENT POLICY ACTIONS	**n/a**	**n/a**	**n/a**			
	SECTOR TOTAL PLUS RECENT POLICY ACTIONS	**6.7**	**14.3**	**109**	**$258**	**$7**	

[a] See quantification in Chapter 4, Table 4-2.

[b] Quantification estimates for ES-11, ES-12, and ES-13 had not been approved by the CCAG at its conclusion. Initial cursory estimates may be found in Appendices H-5, H-6, H-7, and H-8.

Energy Supply Sector
Policy Descriptions

The Energy Supply sector includes emissions mitigation opportunities related to electricity generation and oil and gas production. Electrical energy options include mitigation activities associated with the generation, transmission, and distribution of electricity, whether generated through the combustion of fossil fuels or by renewable energy sources; in a centralized power station supplying the grid or by distributed generation facilities; or in the case of some options, within New Mexico or imported into the state. Oil and gas mitigation options include mitigation activities associated with the extraction, transportation, and processing of oil and natural gas. Sequestration options can apply to both electrical generation and oil and gas production.

ES-1 Mandate(s) for Renewable Energy (RPS, etc.)

A renewable portfolio standard (RPS) is a requirement that utilities acquire a certain percentage of electricity from renewable energy sources. Utilities can meet this requirement by purchasing or generating renewable-based electricity or by purchasing renewable energy credits (RECs).

The CCAG unanimously recommends that New Mexico reduce the carbon intensity of its electricity generation by increasing its existing 10% Renewable Portfolio Standard (RPS) by 1% annually over the period 2011-2021, applicable to all load serving entities. As a stand-alone policy, this measure would reduce New Mexico's GHG emissions relative to reference case levels by approximately 2.6 MMTCO2e by 2020. A majority of the CCAG also supports a more-rapid 2% annual increase in the RPS over 2011-2021.

ES-2 Financial Incentives for Distributed Renewables

This policy option reflects financial incentives to encourage investment in distributed renewables. These financial incentives for distributed renewables include (1) direct subsidies for purchasing/selling distributed renewable technologies given to the buyer;[3] (2) tax credits or exemptions for purchasing distributed renewable technologies given to the buyer, and (3) regulatory policies that provide incentives and/or assurance of cost recovery for utilities that invest in customer-owned renewable energy systems. The policy also includes R&D funding to support development of distributed renewable technologies. R&D funding could be targeted toward a particular technology or group of technologies as part of a state program with a mission to build an industry around that technology in the state and/or to set the stage for adoption of the technology for use in the state. R&D funding could also be made available to any renewable or other advanced technology through an open bidding procedure (i.e., driven by bids received rather than by a focused strategy to develop a particular technology). Funding can also be given

[3] Any direct subsidies or incentives would need to be cleared through the New Mexico Attorney General's Office to ensure that they comport with the anti-donation clause of the New Mexico Constitution.

for demonstration projects to help commercialize technologies that have already been developed but are not yet in widespread use. New Mexico has been striving toward capital buy downs and production incentives such that there is full payback over 25-30 years to those who install distributed renewable options. Additionally, Albuquerque is considering tax incentives for distributed renewables.

The CCAG recommends that New Mexico offer incentives for distributed solar photovoltaic (PV) technologies in order to reduce their payback period to 25 years or less.[4] Very-low-carbon PV generation would displace generation from fossil fuels and correspondingly lower carbon emissions more than otherwise would be the case.

ES-3 Renewable Energy Transmission and Storage

Renewable energy from wind and solar radiation is intermittent by nature, while fossil fuel technologies can be called upon to meet demand as needed. A renewable energy transmission authority (RETA) could be created to assist in the development of energy storage technologies and to foster the development of transmission capacity necessary to take advantage of renewable resources.

The CCAG recommends that New Mexico legislatively establish a Renewable Energy Transmission Authority (RETA) charged with overcoming limitations on renewable energy by fostering the development of (a) renewable energy storage technologies to address intermittency, and (b) transmission capacity necessary to take advantage of available renewable resources. Creation of a RETA as recommended in this non-quantified enabling policy could enhance the penetration of renewable energy resources and contribute to the success of other CCAG-recommended policies. A first step has already been taken in this direction via the introduction of HB111 in the New Mexico Legislature in 2006.

ES-4 Financial Incentives for Centralized Renewables

This policy option reflects a suite of financial incentives to encourage investment in centralized renewables. Financial incentives for centralized renewables could include: (1) direct subsidies for purchasing/selling centralized renewable technologies given to the buyer/seller; (2) tax credits or exemptions for purchasing/selling centralized renewable technologies given to the buyer/seller; (3) tax credits or exemptions for operating centralized renewable energy facilities; (4) feed-in tariff, which is a direct payment to centralized renewable generators for each kWh of electricity generated from a qualifying renewable facility; (5) tax credits for each kWh generated from a qualifying renewable facility; (6) regulatory policies that provide financial incentives through favorable rate treatment to regulated utilities that invest in centralized merchant or utility-built renewable energy projects; and (7) R&D funding to support development of centralized renewable technologies. Incentives could also be linked to or made conditional upon in-state manufacturing of equipment. This policy could also be linked with other carbon policies in order to make them more effective. For example, financial incentives could be provided in conjunction with an RPS in order to (a) provide long-term financial support for renewable developers, (b) help ensure that aggressive levels of renewable generation can be achieved in practice, and (c) provide financial support for certain renewable technologies that would not otherwise be developed.

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[4] Any direct subsidies or incentives would need to be cleared through the New Mexico Attorney General's Office to ensure that they comport with the anti-donation clause of the New Mexico Constitution.

The CCAG recommends that New Mexico implement production tax incentives for centralized renewable energy of 4¢/kWh for solar, 2¢/kWh for biomass, and 1¢/kWh for wind. These incentives would likely be implemented in conjunction with an RPS, so for the purposes of modeling this policy option, it was assumed that these financial incentives are combined with an RPS that increases the existing New Mexico RPS targets by 2% per year from 2010 to 2020. The State should also eliminate the existing 2 million MWH/year overall cap on this incentive; lower the facility size threshold from 10 MW to 1 MW, and extend the tax credit to apply to personal income taxes as well as corporate income taxes.

ES-5 Research & Development (R&D)

R&D funding can be targeted toward a particular technology or group of technologies as part of a state program to build an industry around those technologies in the state and/or to set the stage for adoption of those technologies in the state. Funding can also be given for demonstration projects to help commercialize technologies that have already been developed but are not yet in widespread use.

The CCAG recommends that New Mexico establish an R&D program tasked with the development and deployment of concentrating solar energy technologies, hydrogen-based energy storage technologies, and other energy storage technologies such as compressed air storage, molten salt storage, and cavern storage. This is a non-quantified enabling policy to assist in the achievement of GHG emission reductions though other CCAG-recommended policy options.

ES-6 Advanced Coal/Fossil Technologies (e.g., IGCC with carbon capture)

Advanced fossil technologies such as integrated gasification combined cycle (IGCC) may offer greater efficiency than conventional fossil technologies, and can therefore have lower CO2 emission rates. Advanced fossil technologies combined with carbon capture and sequestration or reuse (CCSR) could enable significantly lower CO2 emissions. Policies to promote advanced fossil technologies for new coal plants may include mandates, incentives, or a combination of the two.

The CCAG recommends that the State encourage all new coal plants in New Mexico, or serving customers in New Mexico, to be built with advanced fossil technologies and CCSR. Because development of an IGCC plant involves risks and uncertainties that have inhibited rapid commercialization, the CCAG recommends an incentive-based approach rather than a mandate. Accordingly, the CCAG recommends that the state develop an incentive package to encourage utilities and independent power producers to develop advanced fossil technologies with CCSR. Incentives should be structured to encourage high rates of CCSR (e.g., net CO2 emission rates no higher than those of a state-of-the-art natural gas combined-cycle generation facility) and should only be offered for advanced fossil technologies with CCSR. Cost recovery for prudent utility investments in advanced fossil technologies with CCSR should be structured to fully compensate utilities. The CCAG also recommends that New Mexico task a state agency (e.g., New Mexico Oil Conservation Division (NMOCD), which has this regulatory authority) to provide technical resources for carbon sequestration, including an evaluation of suitable storage sites, and possibly the administration of incentives.

ES-7 Nuclear Power

The production of electric power in nuclear fission reactors creates little direct GHG emissions. In states with existing nuclear facilities, relicensing can extend their productive life, and uprating can enable more power to be generated, typically by improvements to the steam side of the operation. New Mexico has no existing commercial nuclear power plants to relicense or uprate, however, so its nuclear options are limited to whether or not new nuclear generation capacity should be built.

In evaluating nuclear power options, it is important to consider costs beyond the direct costs for generation, operation, waste storage, and decommissioning. The costs of the unusual risks associated with nuclear power, including taxpayer assumption of reinsurance liability under the Price-Anderson Act and new security costs, should also be considered. At the same time, in the interest of completeness, it is important to include new nuclear capacity as an option. To do otherwise could suggest that the CCAG was inadequately comprehensive in its consideration of available electricity supply alternatives.

Given the highly controversial nature of fission-based nuclear power in the U.S., the CCAG recommends that New Mexico consider whether new nuclear generation capacity is advisable for the State following a qualitative but comprehensive review of all direct and indirect benefits and costs associated with nuclear power. This review should expand upon and include uranium miner safety, environmental contamination from uranium mining, internal nuclear plant safety and security, the safety of surrounding communities in the event of an accidental release of radioactive materials, environmental contamination in the event of an accidental release of radioactive materials, environmental contamination from both on-site and permanent storage of nuclear waste, environmental contamination from possible reprocessing of nuclear waste, and enhanced nuclear weapons proliferation risk due to exercise of the nuclear power option in the U.S. The CCAG decided not to quantify this policy option, lacking a basis to do so until such a comprehensive review is completed.

ES-8 Incentives and Barrier Reductions for Combined Heat & Power (CHP)

Financial incentives for combined heat & power (CHP) could include: (1) direct subsidies for purchasing/selling CHP systems given to the buyer/seller; [5] (2) tax credits or exemptions for purchasing/selling CHP systems given to the buyer/seller; (3) tax credits or exemptions for operating CHP systems; (4) feed-in tariff, which is a direct payment to CHP owners for each kWh of electricity or BTU of heat generated from a qualifying CHP system; and (5) tax credits for each kWh or BTU generated from a qualifying CHP system. There are also numerous barriers to greater penetration of combined heat and power (CHP), including inadequate information, institutional barriers, high transaction costs because of small projects, high financing costs because of lender unfamiliarity and perceived risk, "split incentives" between building owners and tenants, and utility-related policies like interconnection requirement, high standby rates, exit fees, etc. The lack of standard offer or long-term contracts, payment at avoided cost levels, prohibitions on running private wires, and lack of recognition for emissions reduction value provided also creates obstacles.

The CCAG recommends that New Mexico undertake a concerted effort to revise its policies in order to remove or reduce barriers to CHP and the recovery and use of currently wasted energy.[6] For the purpose of modeling, this policy option assumed that 2-3% of the estimated CHP

[5] Any direct subsidies or incentives would need to be cleared through the New Mexico Attorney General's Office to ensure that they comport with the anti-donation clause of the New Mexico Constitution.

[6] New Mexico may wish to review similar policy changes recently enacted in Connecticut, Vermont, Pennsylvania, Nevada, and Rhode Island.

potential in New Mexico could be realized each year from 2008 onward. The potential for these energy sources is estimated to be about 650 MW.

ES-9 Demand-Side Management, Energy Efficiency, and Integrated Resource Planning

This policy option involves increasing the efficiency of electricity use in New Mexico through programs, funds, and/or requirements focusing on demand-side management (DSM) activities. This option is designed to work in tandem with other strategies that the CCAG has recommended that also encourage efficiency gains. Many different policy configurations are possible,[7] including various combinations of energy savings targets, utility spending targets, public benefit charges,[8] tariff riders or enabling legislation (recently enacted in NM), and incorporation of energy efficiency in integrated resource planning (IRP) processes, among others.

The CCAG recommends that New Mexico's DSM, energy efficiency, and IRP policies go beyond what is currently cost-effective to include measures that would be cost-effective when an appropriate value for carbon dioxide emissions is included (i.e., a "carbon adder"), which should lead to larger GHG emission reductions. *This policy option echoes and is quantified under policy option RCI-1, Demand-Side Management and Energy Efficiency Programs.*

ES-10 Transmission Capacity and Corridors

Satisfying the long-term demand for electricity requires not only new generating capacity, along with demand-side measures, but also measures to improve transmission in order to reduce line losses, diminish bottlenecks, and enhance throughput. Advanced composite conductor technologies, capacitance technologies, grid management software, and other technologies may soon become available to increase transmission line carrying capacity as much as threefold. Entirely new transmission lines may also be necessary, although siting new transmission lines can be difficult due to their cost and their actual or perceived impact on health, environment, and the use, enjoyment, and value of property.

The CCAG recommends that when new construction, repairs and upgrades of existing transmission and distribution infrastructure in New Mexico are undertaken, transmission-owning entities should evaluate the cost-effectiveness of incorporating advanced composite conductor technologies, capacitance technologies, grid management software, and other technologies to increase throughput capacity on the grid. The CCAG further recommends that these evaluations take into account reductions in GHG emissions that would result from energy saved due to lower line losses. This policy option was not quantified due to significant cost uncertainties and the uncertain applicability of advanced transmission technologies to New Mexico's electric grid

ES-11 CO2 Capture and Storage or Reuse (CCSR)

Carbon capture and storage or reuse (CCSR) involves capturing carbon and either (1) sequestering it in a geologically sound reservoir or (2) reusing the carbon dioxide to aid in oil extraction or as a feedstock for industrial processes, and perhaps someday as a feedstock that when combined with water could be reformed into liquid fuels. Carbon dioxide can be (and sometimes is being) captured in natural gas extraction. CO2 in commercial natural gas is capped

[7] For an overview of activity in other states, see USDOE/DSIRE summary tables at http://www.dsireusa.org/summarytables/.

[8] Public benefit charge funds are in place in about 15 states, typically adopted as part of electricity restructuring policy/legislation. These funds are collected as surcharge on utility bills, and are typically directed to a mix of energy efficiency, renewable energy, and low-income programs.

at 2.5%, and some gas fields have a much higher concentration. Excess CO2 is removed through processing and currently emitted to the atmosphere. Carbon can also be captured in the process of gasifying coal to liquid fuels. This process is well established in the chemical industry and forms the basis for IGCC electric generating plants.

The CCAG recommends that New Mexico task a state agency (e.g., NMOCD, which has this regulatory authority) to provide technical resources for carbon sequestration, including an evaluation of suitable storage sites, evaluating the technical and economic feasibility of capture and storage, and possibly the administration of financial incentives. Implementation could include financial incentives; mandatory measures – coupled with technical feasibility and cost and investment recovery mechanisms, if appropriate; or both.

The CCAG recommends further evaluation to identify regulatory, technical, and economic factors affecting the use of acid gas injection (i.e., acid gas streams containing both H2S and CO2) in New Mexico. The CCAG suggests focusing on capturing the CO2 currently being vented at natural gas processing plants and acid gas injection at sour gas processing plants. In addition, carbon emissions from fluid catalytic cracking units at oil refineries should be evaluated.

The CO2 reduction goals for this policy option reflect – subject to verification of technical and economic feasibility and reduction potential – the use of acid gas injection for 100% of all sour gas processing by 2020, and the capture, storage, and/or reuse of 7% of CO2 emissions from natural gas processing every year (calculated as 7% of the prior year's emissions) to 2050. These CO2 reduction goals are provided for the sole purpose of partially meeting the targets set by Governor Richardson's directive and are not necessarily confirmed or validated by any current study or analysis regarding economic or technical feasibility. It is the intent of the CCAG to require further study and analysis of CCSR by the NMOCD and other appropriate agencies, and that from this study and analysis, changes in goals and determinations regarding the economic and technical feasibility of CCSR may result. This study should consider sour gas processing facilities (i.e., facilities with sulfur recovery units (SRUs)) separately from natural gas processing facilities.

ES-12 Methane Reduction in Oil and Gas Operations (BMPs & PROs)

There are a number of ways in which methane emissions in the oil and gas industry can be reduced. Natural gas consists primarily of methane, so any leaks during production, processing, and transportation/distribution should be addressed. In addition to reducing potent GHG emissions,[9] eliminating leaks and venting is economically beneficial because it prevents the waste of valuable product. The EPA Natural Gas STAR program offers numerous methods of preventing leaks. These methods, called Best Management Practices (BMPs) and Partnership Reduction Opportunities (PROs) include opportunities to reduce leaks in venting in the production, processing, and transportation/distribution of natural gas.[10]

The CCAG recommends that – subject to verification of technical and economic feasibility and reduction potential: (a) New Mexico implement, on a voluntary basis, all BMPs, PROs, and available technologies starting in 2007 to reduce overall CO2e emissions due to methane emissions from the oil and gas sector by ~20% by 2020; (b) New Mexico actively promote

[9] Methane has 21 times the global warming potential of CO2.
[10] For a complete list, see http://www.epa.gov/gasstar/techprac.htm#tabnav.

participation by oil and gas operators in EPA's Natural Gas Star program and New Mexico's San Juan VISTAS program; and (c) as voluntary measures are implemented, if the State determines that oil and gas operators are not on track to achieve the above goal, the State should implement mandatory approaches where appropriate. Mandatory measures would be implemented only after following formal rule making or statutory change procedures with the appropriate "due process" requirements.

ES-13 CO2 Reduction from Fuel Combustion in Oil and Gas Operations

There are a number of ways in which CO2 emissions in the oil and gas industry can be reduced, including (1) installing new efficient compressors, (2) replacing compressor driver engines, (3) optimizing gas flow to improve compressor efficiency, (4) improving performance of compressor cylinder ends, (5) capturing compressor waste heat, and (6) utilizing waste heat recovery boilers. Policies to encourage these practices can include education and information exchange, financial incentives, and mandates or standards that require certain practices.

The CCAG recommends that New Mexico focus attention on reducing GHG emissions from fuel combustion in the oil and gas industry through education, financial incentives, mandates and/or standards – coupled with cost and investment recovery mechanisms, if appropriate – to: (1) improve the efficiency of compressors; (2) boost waste heat recovery for compressors and boilers including the deployment of CHP systems that could sell excess power back to the grid; and to a lesser extent, (3) replace gas-driven compressors with electrical compressors when doing so reduces CO2 emissions (the average carbon intensity of New Mexico electricity would need to be reduced by approximately 30% to make this option carbon-neutral).[11]

The CO2 reduction goals for this policy option reflect – subject to verification of technical and economic feasibility and reduction potential – a reduction in CO2 emissions from fuel combustion by 75% by 2020. This CO2 reduction goal is provided for the sole purpose of partially meeting the targets set by Governor Richardson's directive and are not necessarily confirmed or validated by any current study or analysis regarding economic or technical feasibility. It is the intent of the CCAG to require further study and analysis of the approaches recommended above by the NMED and other appropriate agencies, and that from this study and analysis, changes in goals and determinations regarding the economic and technical feasibility of these approaches may result.

ES-14 GHG Cap and Trade

A cap and trade system is a market mechanism in which GHG emissions are limited or capped at a specified level, and those participating in the system can trade permits (a permit is an allowance to emit one ton of CO2). By allowing trading, participants with lower costs of compliance can over comply and sell their additional reductions to participants for whom compliance costs are higher. In this fashion, overall costs of compliance are lower than they would otherwise be.[12] Among the important considerations for New Mexico with respect to a power sector GHG cap and trade program are the sources and sectors to which it would apply, the level of the cap, how allocations would be distributed, what offsets would be allowed, over what region the program would be implemented (e.g., nationally, regionally, etc.), and whether

[11] See Attachment H-9 of Appendix H, Energy Supply Policy Recommendations.

[12] The State of California's Climate Action Team recently assembled a good discussion of cap and trade design issues. It can be referenced at: http://www.climatechange.ca.gov/climate_action_team/reports/2005-12-08_CAP+TRADE_REPORT.PDF.

tribally-operated facilities and rural electrical cooperative facilities would be included.

The CCAG recommends that any cap and trade program applicable to New Mexico sources be preferentially implemented on a national or regional (i.e., multi-state) basis.

The CCAG further recommends that the State of New Mexico should lead or participate in a regional collaborative to investigate market-based mechanisms, such as cap and trade and other state policies, that would limit and reduce greenhouse gas emissions in the West and in the Nation. This will be valuable for the region and inform and help shape national legislation to regulate GHG emissions. This investigation should take into account social justice concerns and potential impacts on communities of color.

This policy option was not quantified because New Mexico cannot unilaterally implement a national or regional cap and trade program. However economic modeling was conducted to consider potential GHG reductions and cost ramifications for New Mexico relative to other states under several regional scenarios. This modeling was conducted for the purpose of understanding the potential impacts upon New Mexico of a cap and trade program, not to define the details of a prospective cap and trade regulatory program. Using the Governor's GHG reduction targets as the cap, the CCAG considered scenarios reflecting a national power sector GHG cap and trade program; a regional cap and trade program over the Western Electric Coordinating Council (WECC) states (subject to minor variations as needed to facilitate analysis); and a program over a sub-region of the WECC states selected so as to minimize "leakage" (i.e., sales into the region from unregulated sources outside the region). The CCAG also considered alternative program scenarios covering reflecting all sectors (i.e., an economy-wide approach) as opposed to the power sector alone. Details on the modeling results can be found in Appendix H.

ES-15 Generation Performance Standard

A generation performance standard (GPS) requires electricity utilities or load serving entities (LSEs) to acquire electricity with an average emission rate below a specified mandatory standard. Utilities must take action to ensure that each covered generating facility meets this standard.

The CCAG recommends that New Mexico develop a GPS applicable to any long-term financial commitment for new baseload generation, whether for new plants constructed in the state or for baseload power imported from outside the state. The CCAG also recommends that New Mexico undertake efforts to remove any perverse incentives to continue running existing high-emitting facilities. The GPS level would be equivalent to GHG emissions from a new natural gas combined cycle plant.

ES-16 Regulatory Reform for Electric Cooperatives

As member-owned entities, rural electric cooperatives are often not bound by the same regulatory conditions as investor-owned utilities (IOUs). The latter enjoy monopoly status in the marketplace along with a guaranteed rate of return in exchange for close regulatory oversight to protect customers from undue market power. Electric cooperatives are not seen as requiring similar regulatory oversight because their customers (coop members) are also owners and thus have alternative oversight mechanisms available (e.g., elections of Boards of Directors).

As a result of this key regulatory difference, electric cooperatives are often not subject to the same regulations as IOUs, including state environmental regulations. (They are subject to federal environmental regulations.) Accordingly, the CCAG believes that it is worth considering limited reform of state regulatory provisions so that electric cooperatives face equivalent GHG reduction requirements as IOUs.

Unless otherwise indicated, the analysis of all ES policy options addresses generation statewide, and thus includes electricity generated at tribally owned or operated facilities and at electric cooperatives. While the CCAG remains cognizant that final implementation of ES policy options is likely to vary among IOUs, tribal facilities, and cooperatives, this approach allows policy options to be considered equally across the board. Accordingly, the CCAG recommends this policy option as a non-quantified enabling policy for the electric cooperative-related GHG emission reductions and costs that are already quantified in the ES policy options. To include GHG reductions and costs under specific ES policy options as well as under this generic enabling policy would double-count the associated GHG reductions and costs.

Chapter 6
Transportation and Land Use

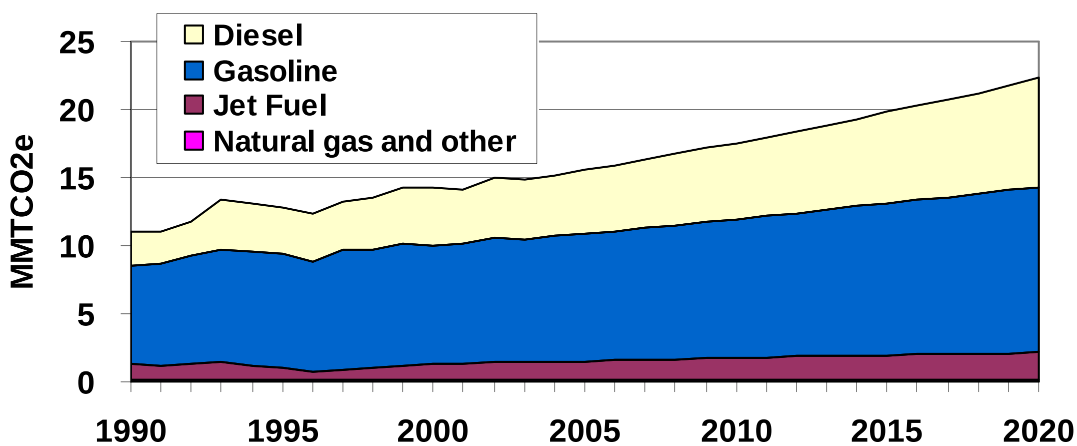
Overview of GHG Emissions

The transportation sector is a major source of GHG emissions in New Mexico – currently accounting for about 18% of the State's gross GHG emissions. The transportation technologies and fuels used are key determinants of those emissions, along with population, economic growth, and various land use policies that all affect the demand for transportation services. GHG emissions from the transportation sector totaled about 14 $MMtCO_2e$ in 2000.

Figure 6-1 shows historical and projected Transportation and Land Use (TLU) GHG emissions by fuel and source, and illustrates their rapid growth. TLU emissions are expected to roughly double from 1990 from 2020. New Mexico studies suggest on-road vehicle miles traveled (VMT) will continue to grow faster than the population, and rapid growth in freight VMT is also expected.

Subsequent to the compilation of the inventory and projections, Congress enacted the 2005 Energy Policy Act which contained a provision for a national renewable fuel standard that will likely increase the use of biofuels in New Mexico. This was classified as a "recent action" and was accounted for in the TLU TWG analysis.

Figure 6-1. Historical and Projected GHG Emissions from the Transportation and Land Use Sector, New Mexico, 1990 to 2020



Key Challenges and Opportunities

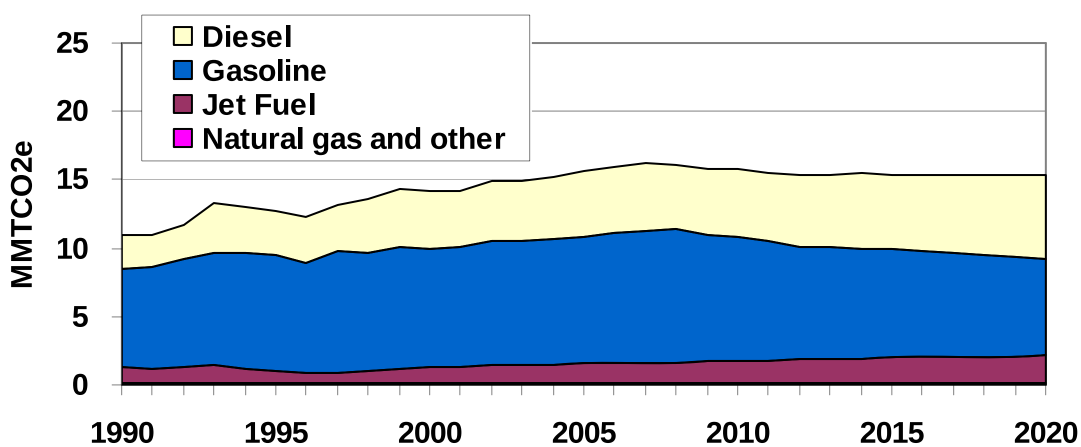
The principal means to reduce TLU emissions include improving vehicle fuel efficiency, substituting gasoline and diesel with lower-emission fuels, modal switches to lower-emission means of travel, and various strategies to decrease the growth in fuel use and VMT.

In New Mexico and in the nation as a whole, vehicle fuel efficiency has improved little since the late 1980s, yet many studies have documented the potential for substantial increases consistent with maintaining vehicle size and performance. The use of biofuels with lower GHG emissions is growing in New Mexico and larger market penetration is possible. New Mexico also has taken some steps to increase transit options and encouraging Smart Growth.

Overview of Policy Recommendations and Estimated Impacts

The CCAG recommends a set of 15 policy options for the Transportation and Land Use sector that offer the potential for major economic benefits and emissions savings. As summarized in Figure 6-2, these policy recommendations could lead to emissions reductions from reference case projections of 6.7 MMtCO_2e per year by 2020, cumulative savings of nearly 50 MMtCO_2e from 2007 through 2020, and net cost savings of over $1.6 billion to the New Mexico economy through the year 2020 on a net present value basis (NPV).[1] The weighted average cost of saved carbon from the policy options for which quantitative estimates of both costs and savings were prepared was -$36 per metric ton of CO_2 equivalent.

Figure 6-2. Impact of Policy Recommendations on GHG Emissions from the Transportation and Land Use Sector, New Mexico[2]



The estimated impacts of the individual policies are shown in Table 6-1 below. The CCAG policy recommendations described briefly here (and in more detail in Appendix I to this Report) result not only in significant emissions and costs savings, but offer a host of additional benefits

[1] The net cost savings are based on fuel expenditures, operations, maintenance, and administrative costs, and amortized, incremental equipment costs. All NPV analyses here use a 5% real discount rate.

[2] The figure includes the effect of the national Renewable Fuel Standard but it is too small to appear graphically.

as well. These benefits include (but are by no means limited to) reduced local air pollution, more livable, healthy communities, and economic development and job growth from in-state biofuel production.

In order for the TLU policy options recommended by the CCAG to yield the levels of savings described here, the options should be implemented in a timely, aggressive, and thorough manner. Notably, the State Clean Car program must clear several hurdles before New Mexico or any other state can adopt it, including EPA approval of the original California Clean Car Program (that other states can then opt into) and a court challenge to the underlying notion of regulation of GHG emissions from vehicles. If for any reason, New Mexico is not able to implement the Clean Car Program, other options could play a larger role. For example, the policies to be studied under the Incentives/Disincentives Options Bundle (TLU-5) could improve fuel efficiency through some combination of "feebates", vehicle excise taxes that vary with fuel economy, and consumer labeling. Feebate proposals usually have two parts: 1) a fee on relatively high emissions/lower fuel economy vehicles; and 2) a rebate or tax credit on low emissions/higher fuel economy vehicles. A multi-state approach to feebates is recommended here because of the drawbacks of New Mexico (or any state) acting alone in this area.

Greater alternative fuel use (TLU-6) can be accomplished through a combination of voluntary and mandatory measures. The Renewable Fuel Standard recommended as part of TLU-6 can increase the use of ethanol and biodiesel, and the incentives recommended in Chapter 7 (Options A-3 and A-11) can promote in-state production of these fuels through methods with lower lifecycle GHG emission. Use of zero emission vehicles running on electricity or hydrogen made from renewable sources can dramatically reduce GHG emissions.

To be most effective, the group of policies aimed at VMT reductions (TLU-7 through TLU-11) will require change at every level of government, and as such will be most effective with focused leadership by the State, including training, outreach, and technical assistance to local governments.

Table 6-1. CCAG Recommended Policy Options and Results for the Transportation and Land Use Sector

	Policy Option	GHG Reductions ($MMtCO_2e$) 2012	2020	Total 2007-2020	Net Present Value 2007–2020 (Million $)	Cost-Effective-ness ($\$/tCO_2e$)	Level of Support
	TRANSPORTATION AND LAND USE						
TLU-1	State Clean Car Program	0.4	1.9	10.4	$1,207	-$117	UC
TLU-2	Low Rolling Resistance Tires	0.5	0.6	5.5	$506	-$92	UC
TLU-3	Low-GHG Operation of State Fleet Vehicles	*Not quantified*					UC
TLU-4	Pay-As-You-Drive Insurance	0.2	1.0	5.0	Zero net cost		UC
TLU-5	Incentive/Disincentive Options Bundle	*Not quantified*					UC
TLU-6	Alternative Fuels Use	0.4	1.7	9.1	-$119	-$13	UC
VMT Reduction Bundle TLU-7 to TLU-11							
TLU-7	Infill, Brownfield Re-development	1.2	1.3	13.4	*Zero net costs or positive cost savings*		UC
TLU-8	Transit-Oriented Development						UC
TLU-9	Smart Growth Planning, Modeling, Tools						UC
TLU-10	Multimodal Transportation Bundle						UC
TLU-11	Promote LEED for Neighborhood Development						UC
TLU-12	Targeted Open Space and Croplands Protection	*Considered in Agriculture and Forestry TWG (F-1 and A-8)*					
TLU-13	Diesel Retrofits	*Incorporated as part of TLU-5*					
TLU-14	Truck Stop Electrification/Anti-Idling	0.4	0.7	6.3	$23	$4	UC
TLU-15	Intermodal Freight Initiatives	0.1	0.5	2.6	*Not quantified*		UC
TLU-16	Lower Speed Limits	0.2	0.3	2.8	*Not quantified*		UC
	SECTOR TOTAL AFTER ADJUSTING FOR OVERLAPS	3.0	6.7	49.4	-$1,669	-36	
	REDUCTIONS FROM RECENT POLICY ACTIONS [a]	0.1	0.1	1.1			
	SECTOR TOTAL PLUS RECENT POLICY ACTIONS	3.1	6.8	50.5	-$1,669	-36	

[a] As noted earlier in the Chapter, the only recent policy action included in the analysis is the national renewable fuel standard enacted in 2005.

Transportation and Land Use Sector
Policy Descriptions

The TLU sector includes emissions and mitigation opportunities related to vehicle technologies, fuel choices, transit options, and demand for transportation services.

TLU-1 State Clean Car Program

The CCAG recommends that New Mexico adopt the State Clean Car Program (also known as the "Pavley" standards or California GHG Emission Standards) in order to reduce GHG emissions from new light-duty vehicles. The standards, which must still be approved by US EPA, would take effect in Model Year 2011 (calendar year 2010). Other Clean Car Program elements include standards requiring reductions in smog- and soot-forming pollutants, and promoting introduction of very low-emitting technologies into new vehicles.

New cars and light trucks in all states must comply with Federal emission standards, and, generally speaking, states have the choice of adopting a stronger set of standards applicable in California. In 2005, California finalized a set of standards that would require reductions of GHG emissions of about 30% from new vehicles, phased in from 2009 to 2016, through a variety of means. Eleven states (11) already have adopted the California Clean Car Program standards: California, Connecticut, Maine, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Rhode Island, Vermont and Washington.

TLU-2 Low-Rolling Resistance Tires

The CCAG recommends that New Mexico improve the fuel economy of the light duty vehicle (LDV) fleet by setting minimum energy efficiency standards for replacement tires and requiring that greater information about Low-Rolling Resistance (LRR) replacement tires be made available to consumers at the point of sale.

Manufacturers currently use LRR tires on new vehicles, but they are not easily available to consumers as replacement tires. When installing original equipment tires, carmakers use low rolling resistance tires as a way to contribute to meeting the federal automobile fuel economy (CAFE) standards. When replacing the original tires, consumers often purchase less efficient tires. Currently, tire manufacturers and retailers are not required to provide information about the fuel efficiency of replacement tires. An appropriate State agency would initiate a fuel efficient tire replacement program. The program could include consumer education, product labeling, and minimum standards elements. These programs would be developed under a rule development process that would incorporate the best scientific information, including the results from tests of tires conducted by the tire manufacturers, the California Energy Commission, and other data reviewed by the National Academy of Sciences.

TLU-3 Low-GHG Operation of State Fleet Vehicles

The CCAG recommends that New Mexico strengthen it's commitment to reduce GHG emissions due to operation of state-owned vehicles by enacting legislation that codifies the provisions of Executive Order 05-049, and requires that the State increase its use biofuels in the fleet of State vehicles to match the annual targets set forth in Option TLU-6 (Alternative Fuels Use). This is an enabling option that would have the State government lead by example, ensuring that its own fleet of vehicles meets or exceeds the targets set for the State as a whole.

TLU-4 Pay-As-You-Drive Insurance

The CCAG recommends that New Mexico change the state insurance regulations to allow Pay-As-You-Drive (PAYD) insurance, and initiate and promote an aggressive pilot of PAYD in 2008. PAYD insurance changes part of vehicle insurance payments from fixed charges to per-mile charges. By allowing people to save money by changing their driving decisions, PAYD reduces VMT and emissions. Assuming this pilot recommended here is successful, market penetration could increase to 100% by 2020. This could happen either through competitive pressure (increasing numbers of companies offer it in order to stay competitive) or through a change in state policy mandating PAYD at some point after it has been shown to work.

TLU-5 Incentive/Disincentive Options Bundle

The CCAG recommends that New Mexico further study and develop policy options that create incentives for the purchase and operation of vehicles that emit low levels of GHGs (and disincentives for the purchase and operation of vehicles that emit high levels of GHGs). The range of policies to be studied and developed include:

- A multi-state "feebate" program, including the neighboring states of California and Arizona.
- A change in new vehicle excise taxes that increases taxes for relatively high-emitting vehicles and reduces taxes for relatively low-emitting vehicles. Overall, excise tax revenue would remain the same.
- A consumer labeling program that provides buyers with better information on the GHG emissions of new vehicles.
- Incentives for diesel retrofits that would encourage the replacement of high-emitting diesel truck engines with newer, less polluting engines.

Together, these incentives could change the vehicle fleet technology mix through a combination of demand- and supply-side changes.

TLU- 6 Alternative Fuels Use

The CCAG recommends that New Mexico expand the availability and use of alternative fuels and expand the use of hybrid vehicles, low speed vehicles, and zero emission vehicles for transportation in New Mexico. The mechanisms for achieving this would be combination of a renewable fuels standard (RFS), financial incentives, outreach, and market-based mechanisms. The RFS would operate according to the table below:

Phase	Year	Percentage of Gasoline to be Replaced by Ethanol	Percentage of Diesel to be Replaced by Biodiesel
1	2009	5%	2%
2	2012	10%	10%
3	2020	20%	20%
4	2050	50%	30%

In the near term, the policy also targets increasing sales of hybrid vehicles and partial ZEVs, while sales of ZEVs are targeted to meet the longer-term goals. Plug-in electric vehicles equipped with batteries would also serve as storage capacity for wind and solar power through grid interconnection (V2G). The CCAG also recommends that New Mexico should build appropriate production capacity for renewables-generated electricity and hydrogen fuels for transportation purposes in New Mexico.

TLU-7 Infill, Brownfield Re-development

The CCAG recommends that New Mexico increase its efforts to reuse land that is already developed but is now vacant, underused, or even mildly polluted, and meet the growing demand by a larger number of households comprised of singles, working parents and single parents for housing located close to services, jobs and transit. New Mexico should move beyond current policies in this area, and:

- Use fiscal, tax and other financing mechanisms to remove barriers to and otherwise support recycling of existing buildings and underused land.
- Adapt planning policies and regulations to give infill and brownfield sites priority for development over sprawling sites at the edges of communities. Include New Mexico government and educational units in these adapted policies and regulations, so that state government buildings, universities, and public schools do not contribute to sprawl.

TLU-8 Transit-Oriented Development

The CCAG recommends that New Mexico expand efforts to supportive of building of compact development around transit stops and clustering employment centers around transit in ways that allow meet transportation needs to be met by foot, bicycle, or transit. New Mexico should promote and expand Transit-Oriented Development (TOD) with strong implementation of the policies recommended in The Report of the Governor's Task Force on Our Communities, Our Future:[3]

- *Tax Increment Financing (TIF) Districts:* The state can expand TIF programs through the extension of its credit resources.
- *State Funding Programs:* Provide state funds for affordable housing and parks, both of which help make TODs successful.

[3] "Livability! The Report of the Governor's Task Force on Our Communities, Our Future", January, 2005. http://www.state.nm.us/clients/dfa/Files/LGD/PLAN/PDF/livability.PDF .

- *Support of Local Governments:* Amend local government enabling laws and provide technical assistance to help local governments take maximum advantage of transit investments.
- *Location of State Facilities:* Locate state facilities (including schools and universities) near transit facilities.
- *State Targeting of Infrastructure Investments:* Legislatively appropriated capital outlay funds, the State Public Project Revolving Loan Fund, and other state-funded infrastructure initiatives should be used for projects that encourage walkable and traditional communities, and are supportive of transit.

TLU-9 Smart Growth Planning, Modeling, Tools

The CCAG recommends that New Mexico expand its efforts in the areas of Smart Growth planning, modeling, and tools, and thus allow, support, and encourage location-efficient growth in communities that are proximate to household needs and amenities (such as jobs, shopping, school, services, entertainment, etc.) as opposed to growth in areas that are not proximate and require greater travel distance and have less mode choice. Smart growth allows for mixed land uses, a range of housing opportunities, and multiple transportation options including pedestrian/bike access. These policies reduce GHG emissions by giving municipalities the tools they need to shift development patterns and reduce vehicle trips and total vehicle miles traveled, while avoiding mandates. Similar to TLU-8, the CCAG recommends that New Mexico should continue to implement and expand the Smart Growth-supportive policies recommended in The Report of the Governor's Task Force on Our Communities, Our Future (see TLU-8 above).

TLU-10 Multi-Modal Transportation Bundle

The CCAG recommends that New Mexico should implement the 2025 Statewide Multimodal Transportation Plan in ways that reduce GHG emissions. The New Mexico 2025 Statewide Multimodal Transportation Plan establishes objectives and implementation strategies that aim to shift the State's focus from roads to an integrated, multimodal system. New Mexico should put special emphasis on:

- Making GHG-optimal use of federal Congestion Mitigation Air Quality funds;
- Expanding transit infrastructure (rail, bus, BRT);
- Improving existing transit service and support facilities,
- Improving transit promotion and marketing (including tax-free and employer-paid Commuter Benefits, and Parking Cash Out);
- Improving bike and pedestrian infrastructure;
- Exploring additional commuter rail using existing rail corridors;
- Reviewing all proposed transportation projects for multi-modal flexibility (e.g., add or reserve room for Bus Rapid Transit) or light rail if feasible);
- Conducting research into new transportation technologies and urban planning techniques;
- Supporting and promoting policies that improve transportation system performance through non-transportation actions, such as a 4-day work-week and telecommuting.

TLU-11 Promote LEED for Neighborhood Development

The CCAG recommends that New Mexico recognize the lower emissions and reductions in other public costs of development meeting "LEED-ND" standards. The LEED (Leadership in Energy and Environmental Design) Green Building Rating System® is a voluntary, consensus-based national standard for developing high-performance, sustainable buildings. The "LEED for Neighborhood Development (LEED-ND)" rating system will integrate the principles of smart growth, urbanism, and green building into the first national standard for neighborhood design. LEED-ND will emphasize smart growth aspects and neighborhood design of development while incorporating a selection of the most important green building practices. LEED-ND ratings will include measurements of a development's compact design, proximity to transit, mixed use, mixed housing type, and pedestrian- and bicycle- friendliness.[4] New Mexico should:

- Support municipalities in quantifying the local benefits of LEED-ND developments, and lowering development fees appropriately;
- Require LEED-ND compliance for developments involving state facilities or funding;
- Support the New Mexico building and real estate industries and the non-profit US Green Building Council in promoting LEED-ND to the public and others.

TLU – 14, Truck Stop Electrification/Anti-Idling

The CCAG recommends that New Mexico develop and implement a statewide ordinance banning idling by heavy-duty vehicles in most situations. The State should also set up truck stop electrification stations at key truck stops and truck rest areas along the major highways in New Mexico.

This policy option involves reducing the amount of time that vehicles idle through the combination of a statewide anti-idling ordinance and by promoting and expanding the use of technologies that reduce long-term heavy-duty vehicle idling, with an emphasis on encouraging the use of innovative truck stop electrification. Anti-idling control measures reduce fuel consumption and emissions from stationary freight vehicles (potentially wasted energy). With truck stop electrification, truck drivers can shut off their engines and obtain heating, cooling, electrical outlets, and communication and entertainment options through a delivery tube provided in electrified truck stop spaces that connect to the truck through a window adapter. In addition to truck stop electrification, other available technologies that reduce heavy-duty vehicle idling include automatic engine shut down/start up system controls; direct fired heaters (for providing heat only); and auxiliary power units.

TLU-15 Intermodal Freight Initiatives

The CCAG recommends that New Mexico implement policies and programs that result in the shifting of the transport of freight goods from the roadway system to rail. This should include evaluating the feasibility of restoring abandoned rail lines to increase the attractiveness of using rail for local shipments.

Carrying freight by rail rather than truck can significantly reduce emissions and fuel consumption, while at the same time reducing congestion on major roadways. A number of small abandoned rail lines already exist in New Mexico. A primary goal of this measure is to restore those lines, which will allow freight to be carried by rail directly to a number of warehouses and industrial sites in existing developed areas. This would also provide an incentive to reduce sprawl from these businesses. Electrifying rail should also be considered.

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[4] http://www.usgbc.org/LEED.

New Mexico currently has 2,151 miles of railroad in operation. In many cases, particularly for long distance freight, freight can be carried by rail more economically and at lower GHG emission levels than over the existing roadway system. This policy is designed to transfer a portion of the freight carried over the roadway system to rail wherever possible.

TLU–16 Reduced Speed Limit for Commercial Trucks

Reduced vehicle speeds increase fuel economy, reduce CO_2 emissions, and improve safety. The CCAG recommends that New Mexico consider various options to reduce speed limits in the state including trucks only (60 mph) and all traffic (60 or 65 mph).

Chapter 7
Agriculture and Forestry

Overview of GHG Emissions

The agriculture and forestry (AF) sectors are directly responsible for a small amount of New Mexico's current GHG emissions. For agriculture, net emissions were 6.0 MMtCO2e in 2000. Agricultural emissions include CH4 and N2O emissions from enteric fermentation, manure management, agriculture soils and agriculture residue burning. As shown in Figure 7-1, emissions from agricultural soils and enteric fermentation in cattle account for the largest portions of agricultural emissions. The agricultural soils category includes N2O emissions resulting from activities that increase nitrogen in the soil, including fertilizer (synthetic, organic and livestock) application and production of nitrogen fixing crops.

The contribution from manure management has grown significantly since 1990 and is projected to contribute nearly a third of the emissions within the next five to ten years. GHG emissions from agricultural burning are estimated to contribute a very small amount to the agricultural sector emissions. Figure 7-1 shows that little growth is expected in emissions from the agricultural sector beyond 2005.

Forestland emissions refer to the net CO2 flux[1] from forested lands in New Mexico, which account for about 27% of the state's land area. As shown in Table 7-1, US Forest Service data suggest that New Mexico forests and the use of forest products sequestered on average nearly 21 MMtCO2e per year from 1987 to 1997. The data show an accumulation of carbon in each of the forest carbon pools during this period, except for the harvested wood products and landfilled forestry waste pools.[2] These rates of sequestration are assumed to remain constant through 2020.

Opportunities for GHG mitigation in the AF sector involve measures that can reduce emissions within the sector or reduce emissions in other sectors. For example, production of liquid biomass fuels can offset emissions in the transportation sector, while biomass energy can reduce emissions in the energy supply or RCI sectors. The primary opportunities for GHG mitigation are as follows:

- *Production of renewable fuels (in-state production from in-state feedstocks)*: production of renewable fuels, such as ethanol from crops, crop residue, forestry residue or municipal solid waste, can produce significant reductions when they are used to offset consumption of fossil fuels (gasoline consumption in the transportation sector). This is particularly true when these fuels are produced using processes and/or feedstocks that emit much lower GHG emissions than those from conventional sources;

[1] "Flux" refers to both emissions of CO2 to the atmosphere and removal (sinks) of CO2 from the atmosphere.
[2] This is not to say that the dead carbon pools (e.g., standing dead, forest floor) are sequestering carbon directly from the atmosphere. These pools accumulate carbon from trees/biomass that transition from a live carbon pool to a dead carbon pool.

- *Beneficial use of forest biomass*: expanded use of biomass energy from residue removed from forested areas during treatments to reduce fire risk can achieve GHG benefits by offsetting fossil fuel consumption (either to produce electricity or heat);

Figure 7-1. Historical and Projected GHG Emissions from the Agriculture Sector, New Mexico, 1990 to 2020

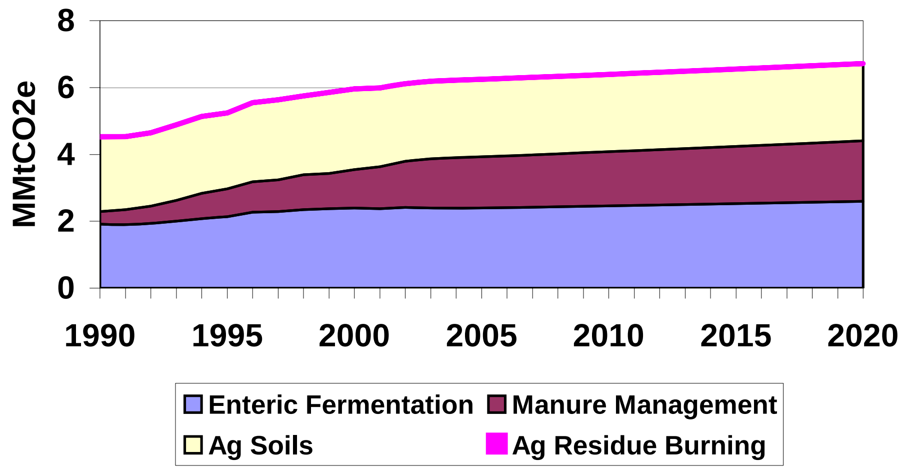


Table 7-1. GHG Emissions (Sinks) from Forestry

Forest Carbon Pool	**1990 – 2020[a] MMtCO$_2$e**
Live and dead-standing trees and understory	-13.6
Forest floor and coarse woody debris	-3.1
Soils	-5.9
Wood products and landfills	1.8
Total	**-20.9**

[a] Based on USFS data from 1987-1997.

- *Control and utilization of methane at dairies*: methane emissions from manure management can be reduced through the use of anaerobic digesters or other technology. The methane captured can then be used to create electricity, steam, or heat to offset fossil fuel use;
- *Protection of forest and agricultural land from conversion to developed use*: by protecting these areas from development, the carbon in above-ground biomass and below-ground soil organic carbon can be maintained and additional emissions of CO2e to the atmosphere can be avoided;
- *Support of local farming and food networks*: by offsetting a portion of imported food with locally grown and produced food, GHG reductions can be achieved by reducing the emissions associated with food transportation;

- *Utilize crop residues for heat or electricity production:* crop residues that currently have no significant market (e.g. as animal feed) can be used as an energy source for commercial, industrial or residential applications;
- *Support of organic farming*: organic farming has been shown to result in significant increases in soil carbon as compared to conventional cultivation. Additional GHG reductions are also possible to the extent that organic techniques reduce fossil fuel consumption due to less intensive use of farm equipment; and
- *Retention of agricultural soil carbon*: programs that incentivize growers to keep lands in conservation programs, instead of returning them to active cultivation, will retain the soil carbon in these lands. This issue is especially important given the number of acres due to expire from the federal Conservation Reserve Program in upcoming years.

Additional opportunities for reducing GHGs include: nutrient management to reduce the amount of nitrogen applied and subsequent GHG emissions; and application of conservation tillage/no-till practices on additional croplands in New Mexico. Conservation tillage/no-till practices, as practiced in organic farming, increase the levels of organic carbon in the soil, which indirectly sequesters carbon from the atmosphere.

Key Challenges and Opportunities

In the agricultural sector, production of ethanol and biodiesel were found to offer substantial GHG reduction potential with an estimated 2020 reduction of 1.25 MMtCO2e (combined benefit of Options A-3 and A-11). This is the benefit from in-state production using New Mexico grown feedstocks and/or lower GHG production methods. The benefit is incremental to the benefit achieved via the renewable fuels standards incorporated in TLU Option 6. The benefits for both biodiesel and ethanol are based on production methods and feedstocks that have lower GHG emissions than conventional processes. For ethanol, this means processes that achieve much better GHG reductions than the production from conventional corn-based ethanol. These processes could include cellulosic hydrolysis, biomass gasification combined with biofuels production, or alternative starch-based production (fermentation processes fueled by renewable fuels). For biodiesel, crop production should be promoted that results in significantly better vegetable oil yields than soybean oil, which is currently the most prominent feedstock in the US. Candidates include vegetable oil crops like canola, sunflower, or jatropha that have much higher yields or emerging technologies like algal oil production that could be particularly well-suited to portions of the state.

For biofuels, challenges in New Mexico will be to identify and promote appropriate feedstocks for the production of these fuels. Limited analysis by the CCAG suggests that sufficient feedstock for cellulosic ethanol is available to meet the increased consumption to result from the TLU renewable fuels standard (without affecting existing markets for these materials). There is limited capacity within the state for crop production to support biodiesel production without the use of cropland that is currently used for other purposes or is part of the Conservation Reserve Program. Hence, careful study is needed to identify available croplands and appropriate crops for vegetable oil production. Funding and/or incentives will be needed to support the development of biofuels production capacity, including research and development (for production processes and feedstocks) and scale-up of production facilities. In addition to vegetable oil, sufficient planning is needed to promote in-state production for the other primary feedstock to biodiesel (methanol or ethanol). The CCAG is unaware of any commercial-scale production of methanol from renewable resources; however both Federal and private ventures are underway (ethanol is currently produced in New Mexico from starch-based feedstocks). Additional research and development will be needed to assure that these alcohols are produced from renewable in-state resources to maximize the GHG benefits (e.g., manure energy, biomass gasification, cellulosic hydrolysis).

As shown in the policy option descriptions in Appendix J, the implementation mechanisms developed for the agricultural sector should focus on methods that avoid conflict with potential future market-based GHG reduction programs. These include GHG credits that could be generated in the agricultural sector through renewable fuels projects, soil carbon projects, and possibly other project types. New regulations that mandate emission reductions or specific agricultural practices could limit New Mexico agriculture from taking part in emerging carbon markets. Implementation mechanisms that are incentive and education based can avoid these conflicts.

Combining the agricultural and forestry land protection options (F-1 and A-8), 0.33 MMtCO2e/yr in GHG emissions is estimated to be saved in 2020. To achieve these reductions, the state will need to work closely with local planning agencies, land owners, and non-governmental organizations to identify lands suitable for acquisition/conservation easements and funding mechanisms. Another benefit to these options, which was not quantified, is the reduction in vehicle-miles traveled due to more efficient development patterns.

Adoption of organic farming methods (Option A-9) has been shown to result in significant benefits by 2020 (0.4 MMtCO2e/yr). Only the reductions achieved through increases in soil carbon have been quantified. The challenges in New Mexico will be to identify and communicate opportunities for growers to adopt these methods in order to achieve the levels of participation envisioned in the policy design (352,000 acres by 2020, which represents 70% of vegetable and field crop production). A strong educational and outreach program will be needed. Closely associated with the organic farming option is the conservation tillage/no-till option (A-6). This option will also result in increases in soil carbon, thereby sequestering carbon dioxide (0.13 MMtCO2e sequestered in 2020 or 0.08 MMtCO2e after accounting for the overlap with Option A-9).

Option A-10 seeks to promote local farming programs and food systems that achieve significant reductions in food transportation-related GHG emissions. The CCAG estimates that if 25% of food consumed in New Mexico is supplied by in-state production by 2020, then over 1 MMtCO2e/yr could be avoided. Challenges for the state will be to develop new programs and/or enhance existing programs to the levels needed to achieve the policy's goals. Methods to better characterize the existing food distribution system in New Mexico are needed, as well as methods to monitor a transition of the system toward more locally produced products.

Option A-7 seeks to retain in an uncultivated state cropland that is about to expire from the Conservation Reserve Program, thereby preventing the oxidation of soil carbon and subsequent CO2 emissions. The CCAG recognizes that additional work is needed to identify appropriate implementation approaches for this option.

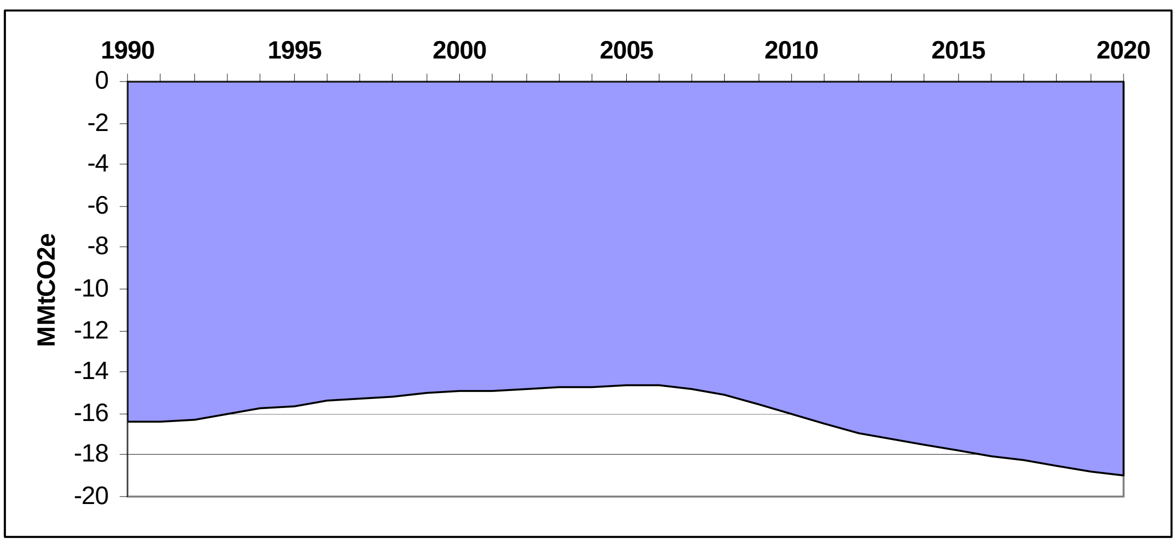
Also in the forestry sector, utilization of biomass recovered from forest health & restoration projects (Options F-2a and b) has a significant potential for GHG benefits (0.6 MMtCO2e/yr by 2020). The estimated benefits focused on those obtained by utilizing biomass energy from forest treatment projects (to reduce fire risk). Success will be achieved through close cooperation between New Mexico, federal agencies (USFS), and private industry to identify biomass resources and effective end uses for the resource.

Overview of Policy Recommendations and Estimated Impacts

The CCAG recommends a set of 12 policy options for the AF sector that offer the potential for major economic benefits and emissions savings. Figure 7-2 shows the estimated impacts of the emissions savings on the AF sector emissions. This figure shows the net AF emissions (including forestry sinks) combined with the GHG emission reductions estimated for the recommended policy options. Net emissions of -14.7 $MMtCO_{2e}$ in 2005 are reduced to -19.0 $MMtCO_2e$ in 2020. The figure shows the effects of the policy options in one data series, since the AF policy options achieve emission reductions not only from the AF source sectors, but in other source sectors as well (e.g., transportation sector due to biofuels production; energy supply or RCI from biomass energy production).

As summarized in Table 7-2, the AF policy recommendations could lead to emissions reductions from reference case projections of 4.8 $MMtCO_2e$ per year by 2020, cumulative savings of over 41 $MMtCO_2e$ from 2007 through 2020, and net cost savings of over $195 million through the year 2020 on a net present value basis (NPV).[3] The weighted average cost of saved carbon from the policy options for which quantitative estimates of both costs and savings were prepared was -$5 per metric ton of CO_2 equivalent. Although a cost estimate for Option A11 (Biodiesel Production) was not developed, the CCAG believes that would still be a net savings to the New Mexico economy in implementing this package of options.

Figure 7-2. Impact of Policy Recommendations on Net GHG Emissions from the Agriculture and Forestry Sector, New Mexico



[3] The net cost savings are based on fuel expenditures, operations, maintenance, and administrative costs, and amortized, incremental equipment costs. All NPV analyses here use a 5% real discount rate.

The estimated impacts of the recommended policies are shown in Table 7-2. The CCAG policy recommendations described briefly here (and in more detail in Appendix J to this Report) result not only in significant emissions and costs savings, but offer a host of additional benefits as well. These benefits include (but are by no means limited to): 1) Support of New Mexico agricultural producers in the production of biofuels crops, development of new markets for agricultural byproducts, production of crops to support locally consumed foods, and training/outreach covering energy production and organic farming; 2) Creation of jobs in the biomass energy and liquid biofuels feedstock/production industries; 3) Healthier forests with lower fire risk through the development of markets for forestry residue; and 4) Research and development work to be conducted by New Mexico universities to support many of the policies for this sector.

Table 7-2. CCAG Recommended Policy Options and Results for the Agriculture and Forestry Sector

	Policy Option	GHG Reductions ($MMtCO_2e$) 2012	2020	Total 2007-2020	Net Present Value 2007–2020 (Million $)	Cost-Effective-ness ($\$/tCO_2e$)	Level of Support
	AGRICULTURE AND FORESTRY						
F-1	Forestland Protection from Developed Uses	0.1	0.1	1.2	$46	$22	UC
F-2a	Forest Health & Restoration - Residential Lands	0.2	0.2	2.5	-$115	-$46	UC
F-2b	Forest Health & Restoration – Other Lands	0.5	0.5	6.3	-$92	-$15	UC
A-1	Manure Energy Utilization	0.3	0.8	6.3	$29	$3	UC
A-2	Biomass Feedstocks for Electricity or Steam Production	0.2	0.3	2.6	-$198	-$76	UC
A-3	Ethanol Production	0.5	1.0	7.5	$20	$3	UC
A-6	Conservation Tillage/No-Till	0.1 [a]	0.1 [a]	0.6 [a]	$14	$15	UC
A-7	Convert Agricultural Land to Grassland or Forest	0.4 [b]	0.4 [b]	4.0 [b]	$27	$7	UC
A-8	Reduce Permanent Conversion of Agricultural Land and Rangeland to Developed Uses	0.1	0.2	1.6	$97	$62	UC
A-9	Programs to Support Organic Farming	0.2	0.4	4.4	$2	$0.5	UC
A-10	Programs to Support Local Farming/Buy Local	0.3	1.1	5.9	$1	$0.2	UC
A-11	Biodiesel Production	0.1	0.3	2.3	*Not quantified* [c]		UC
	SECTOR TOTAL AFTER ADJUSTING FOR OVERLAPS [b]	2.5	4.8	41.0	-$198	-5	
	REDUCTIONS FROM RECENT POLICY ACTIONS	0	0	0			
	SECTOR TOTAL PLUS RECENT POLICY ACTIONS	2.5	4.8	41.0	n/a	n/a	

[a] The GHG benefits for this option overlap with the soil carbon benefits derived from Option A9 on Organic Farming. The overlap has been adjusted in the first set of totals.

[b] Emission reductions are taken against emissions that have not been built into the existing forecast for NM. They refer to emissions associated with acreage assumed to be coming out of the Conservation Reserve Program and returned to active cultivation. Since they aren't included in the baseline, these reductions are left out of the totals.

[c] Not quantified. Information on funding levels needed to promote biodiesel feedstock production was not identified.

[d] Does not include A-7. See footnote b.

Agriculture and Forestry Sector
Policy Descriptions

The Agriculture and Forestry Sectors include emissions and mitigation opportunities related to use of biomass energy, protection and enhancement of forest and agricultural carbon sinks, control of agricultural methane emissions, production of renewable fuels, and reducing transport emissions from imported agricultural commodities. As described in the options descriptions in Appendix J, the CCAG recommends policies in the agriculture featuring implementation methods that are voluntarily implemented by individual producers.

F-1 Forestland Protection from Developed Uses

Reduce the rate at which existing forestlands and forest cover are cleared and converted to developed uses or damaged by development that reduces productivity.

The CCAG recommends that policies be developed to decrease the conversion of forest and woodlands to urban and other developed uses to 30 percent or less of the rates of loss to these uses during the 1987-1997 period by 2012 and to 50 percent or less by 2020. A 50% reduction would decrease the conversion rate from 3,900 acres/year to about 1,900 acres/year. By reducing the rates of conversion, both above- and below-ground carbon can be retained, the sequestration potential of these lands is retained, and GHG emissions associated with travel are indirectly reduced via reducing commute distances.

F-2a and b Forest Health & Restoration

Manage sustainable thinning or biomass reduction from residential forestlands (intended to address fire and forest health issues) so that harvested biomass is directed to wood products and renewable energy instead of open burning or decay. F-2a is directed at residential lands (the wildland-urban interface or WUI) and F-2b is directed at non-WUI areas.

Some efforts to reduce biomass in residential forests and woodlands for forest health/sustainability and wildfire suppression include some emphasis on using the extracted woody biomass for wood products and/or energy production (e.g. local residential firewood). However, a large portion of these materials are managed through open burning, or storage or decay off site. The CCAG recommends placing a greater emphasis on wood products and/or energy production, through appropriate mechanisms, incentives, etc. More specifically, the CCAG recommends utilizing 50% or more of the biomass extracted from both Wildland Urban Interface (WUI) and non-WUI areas for wood products and/or energy production by 2012 and continuing through 2020.

A-1 Manure Energy Utilization

Reduce methane emissions from livestock manure through the use of manure digesters installed at dairies. Energy from the manure digesters is used to create heat or power, which offsets fossil fuel-based energy production and the associated GHG emissions. The goal is to manage dairy manure using anaerobic digesters or other energy capture technology (e.g. biomass gasification) covering 15% of the state-wide dairy population by 2012, 35% by 2020, and 50% by 2050. The policy reduces emissions by offsetting fossil fuel consumption, as well as direct reduction of methane emissions.

A-2 Biomass Feedstocks for Electricity or Steam Generation

Displace fossil fuel usage through the use of agricultural byproducts (e.g., orchard trimmings, other crop residue) as a feedstock for electricity or steam production. The CCAG recommends a goal of using 25% of available biomass by 2012, 50% of available agricultural biomass by 2020, and 75% by 2050. The GHG savings occur as a result of displacing fossil fuel use in the production of electricity or steam. The CCAG recognizes that available biomass is limited to agricultural byproducts that are both technically and economically feasible to recover.

A-3 Ethanol Production

The CCAG recommends that New Mexico adopt programs that align in-state production with the TLU Option 6 ethanol renewable fuels consumption goals of 10% of New Mexico gasoline consumption by 2012, 20% of gasoline consumption by 2020, and 50% of gasoline consumption by 2050. The CCAG recognizes that in-state production goals could be limited by available cropland and waste feedstocks. Careful planning and monitoring of the ethanol production industry will be needed. State incentives should be directed at in-state feedstocks and production methods that achieve much better lifecycle GHG emission reductions than conventional starch-based ethanol production (the benefits of which have already been accounted for under TLU Option 6).

A-6 Conservation Tillage/No-Till

The amount of carbon stored in the soil can be increased by the adoption of conservation tillage. Reducing mechanical soil disturbance reduces the oxidation of soil carbon compounds and allows more stable aggregates to form. In addition to soil carbon benefits, conservation tillage has numerous co-benefits including reduced wind and water erosion, reduced fuel consumption and improved wildlife habitat. The CCAG's goal is to bring an additional 650,000 acres into conservation tillage/no-till production by 2015 and 1,300,000 acres by 2025. Note that this option has overlap with Option A-9 on Organic Farming (no-till is a common organic farming technique). The overlap in the benefits for these options have been addressed in Table 7-2.

A-7 Convert Agricultural Land to Grassland or Forest

Increase carbon sequestration in agricultural land by converting marginal land used for annual crops to permanent cover (grassland/rangeland or orchard). Also, prevent the loss of soil carbon in the future associated with cropland currently in the Conservation Reserve Program (CRP). Adopt mechanisms to either keep these cropland acres in the CRP or prevent them from either returning to conventionally tilled production or to suburban/urban development.

The CCAG did not identify significant opportunities for conversion of marginal agricultural land in New Mexico; however the protection of CRP acres and their associated soil carbon, is a significant issue. Since the conversion of the expiring CRP acres into cultivated acres was not built into the forecast of emissions, the reductions associated with this option (i.e. those associated with the protection of soil carbon) were not included in the summary totals for the AF sector.

A-8 Reduce Permanent Conversion of Agricultural & Rangeland to Developed Uses

The CCAG recommends that New Mexico adopt programs to reduce the rate at which agricultural lands are converted to developed uses, while protecting private property rights and responsibilities. These recommendations are aligned with the goals of the analogous option for forested lands (F1). The policy should be initiated by 2010 and it should achieve a 30% reduction by 2012; a 50% reduction should be achieved by 2020. By 2020, achieving these goals would save 8,600 acres of land per year from being converted to developed use. This would retain the above- and below-ground carbon on these lands, as well as the carbon sequestration potential of these lands. Transportation emissions would be reduced indirectly through more efficient development and lower vehicle use.

A-9 Programs to Support Organic Farming

The CCAG recommends that New Mexico adopt programs to achieve a long-range goal of increasing organic-certified and non-certified-organic acreage to approximately 70% of the cropland used for vegetable and field crop production in the state by 2050. The organic production acreage could increase to 352,000 acres by 2020 depending on drought impacts and the availability of water. The CCAG believes that the goal of this option is achievable if sufficient market growth for organic products occurs by 2050. The GHG benefits of organic production are due to its higher levels of soil carbon (indirectly sequestering CO_2 from the atmosphere). It also uses fewer chemical inputs, which reduces the GHG emissions associated with the production and transport of these products.

A-10 Programs to Support Local Farming/Buy Local

The CCAG recommends that New Mexico adopt programs to increase the amount of locally produced food consumed in the state. From today's approximate 3 percent consumption of local food (much of this is dairy products), by the year 2012, local food systems need to be constructed to shift to 8% local food consumption, and to 25% by 2020. Reductions in GHG emissions occur through offsetting imported foods with high embedded GHG (from transportation) with local foods that have significantly lower embedded GHG.

A-11 Biodiesel Production

The CCAG recommends that New Mexico adopt programs to increase the amount of biodiesel produced within the state. The goals are to produce enough biodiesel to meet 10% of New Mexico diesel consumption by 2012, 20% by 2020, and 50% by 2050. This option is paired with TLU Option 6, which targets methods to increase biodiesel consumption in the state. Optimum GHG benefits are achieved when the biodiesel consumed in the state is produced in-state from crops that are much more efficient than conventional crops (i.e. soybean oil). There appears to be limited in-state capacity for significant vegetable oil production (one of the primary feedstocks for biodiesel production). Therefore, this option includes incentives for research and development of cropping systems and emerging technologies (e.g. algal biodiesel), as well as scale-up of these cropping/production systems to commercial scale.