

Chapter 2

Inventory and Forecast of GHG Emissions

Introduction

Executive Order 05-033 directed the NMED to prepare an inventory of Arizona'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 to global average radiative forcing on a Global Warming Potential (GWP) weighted basis.

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 tons³ (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 MMtCO₂e per year. If these estimates are applied to 2000, the State's *net* GHG emissions would be 62 MMtCO₂e, 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.

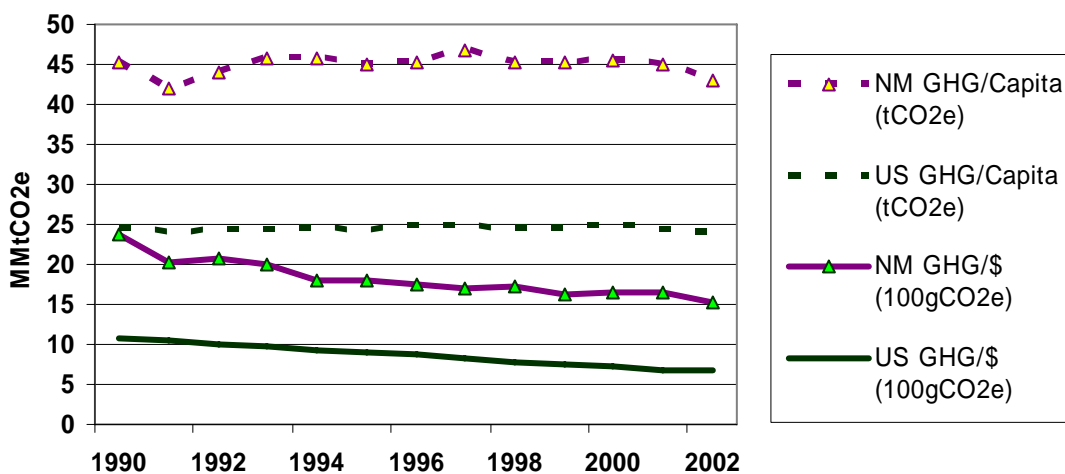
On a per capita basis, New Mexico produces near twice the GHG emissions as the national average (45 vs. 25 tCO₂e per person). New Mexico's high per capita emissions are largely the result of its GHG-intensive gas, oil, and electricity production industries. Figure 2-1 shows that, like the nation as a 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.

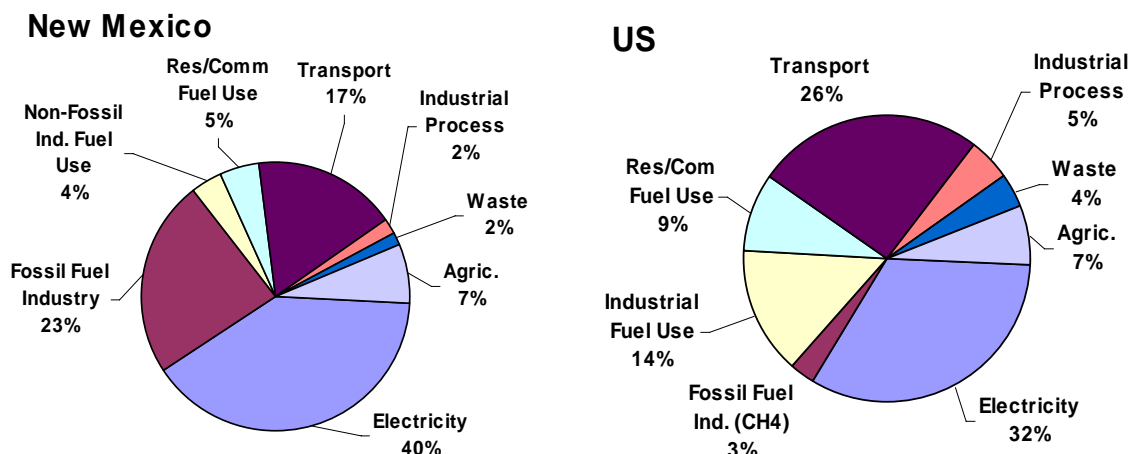
Emissions of carbon dioxide and methane occur at many stages of the fossil fuel production and delivery process (drilling, production, processing/refining, and pipeline transport), and can be highly dependent upon local resource characteristics (e.g., pressure, depth, water content, gas concentrations), 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 CO₂ or CH₄ 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 MMtCO₂), 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.

MMtCO₂), and methane vented and flashed at well sites, processing plants, and pipelines (5 MMtCO₂e). 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

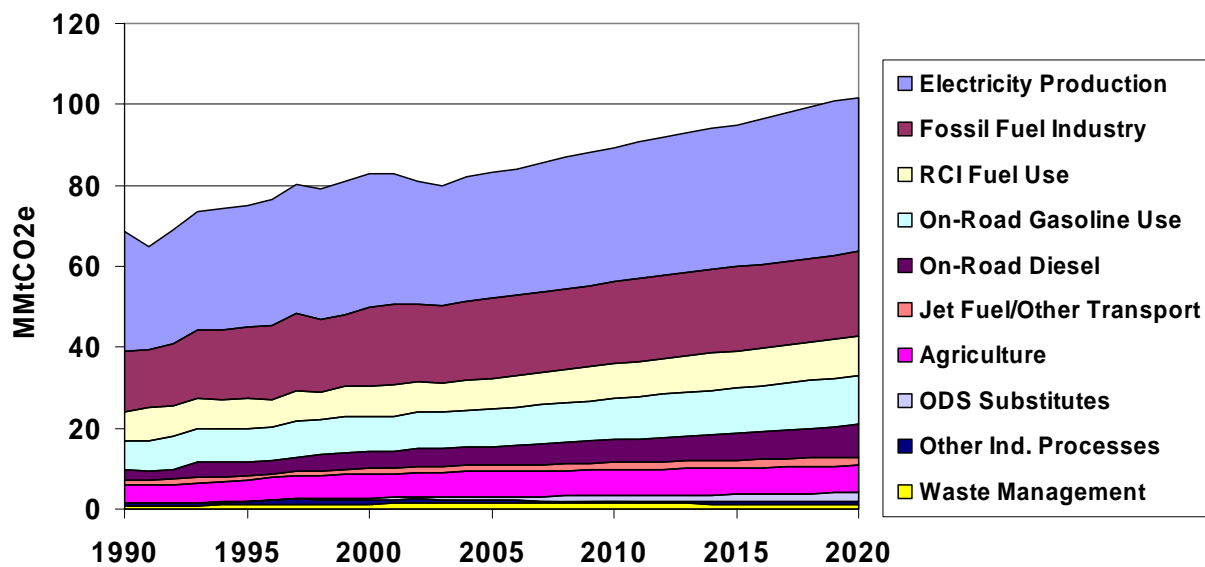
Relying on US DOE and New Mexico agency projections of population, employment, and electricity use, input from NMED staff and industry experts, we developed a simple reference case projection of GHG emissions through 2020.⁷ The reference case assumes a continuation of current trends and reflects, to the extent possible, power plants under construction and the implementation of recently enacted policies, such as the State's Renewable Portfolio Standard, which currently requires investor-owned utilities to provide 10% of the electricity sales from

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

renewable sources by 2011.⁸ As reference case projections are finalized through collaboration with stakeholders and technical work groups, it will be important to consider other existing and planned actions, as well as the basic assumption underlying these projections (See Table 2-3 below).

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 MMtCO₂e, 8% above year 2000 levels. By 2020, they would climb another 14% to 102 MMtCO₂e, 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



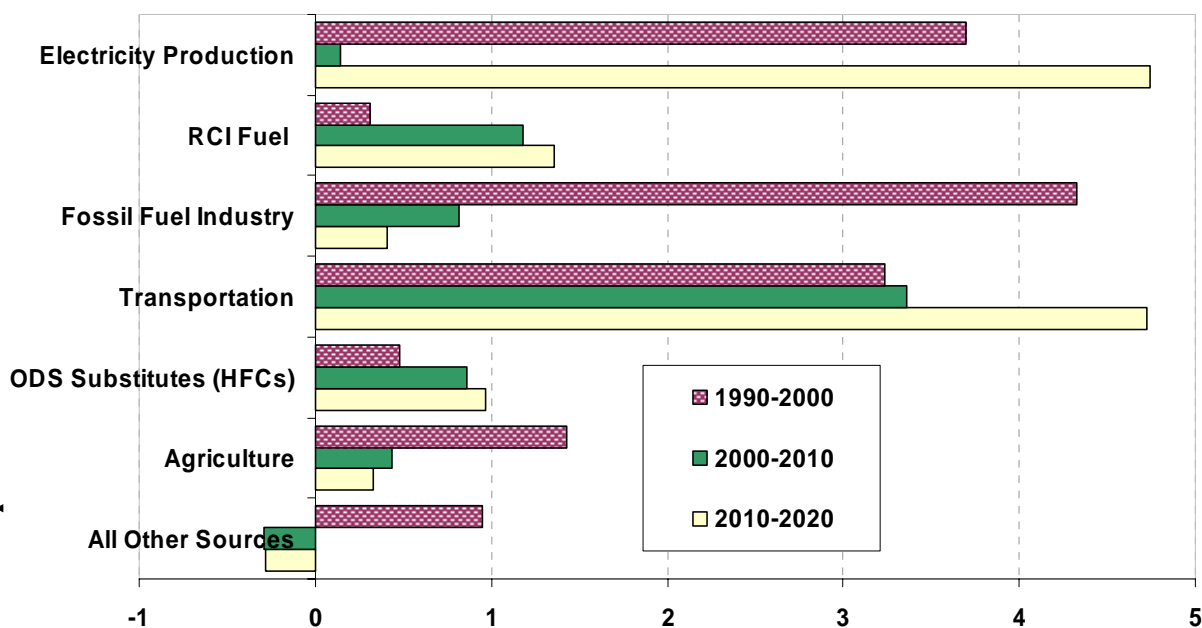
⁸ http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=NM05R&state=NM&CurrentPageID=1

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

| (Million Metric Tons CO₂e) | 1990 | 2000 | 2010 | 2020 |
|---|--------------|--------------|--------------|--------------|
| Energy | 62.6 | 74.2 | 79.7 | 90.9 |
| Electricity Production | 29.5 | 33.2 | 33.3 | 38.1 |
| 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 | 101.7 |
| <i>change relative to 1990</i> | | +21% | +31% | +48% |
| <i>change relative to 2000</i> | | | +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 | 80.8 |
| <i>change relative to 1990</i> | | +30% | +44% | +70% |
| <i>change relative to 2000</i> | | | +11% | +30% |
| Per Capita Gross Emissions (Mt) | 45 | 46 | 42 | 43 |
| Per Capita Net Emissions (Mt) | 31 | 34 | 32 | 34 |

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

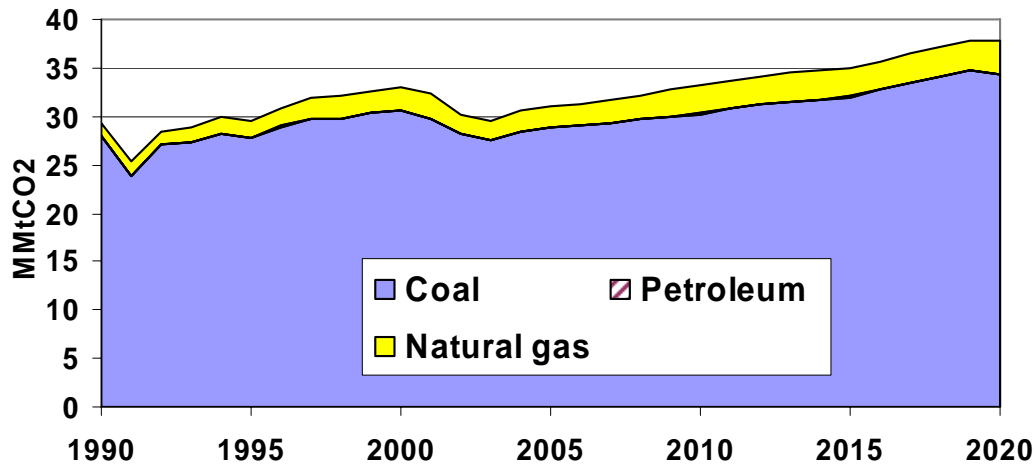
Figure 2-1. Contributions to Emissions Growth, 1990-2020: Reference Case Projections (MMTCO₂e)



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.⁹ 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.

⁹ 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.

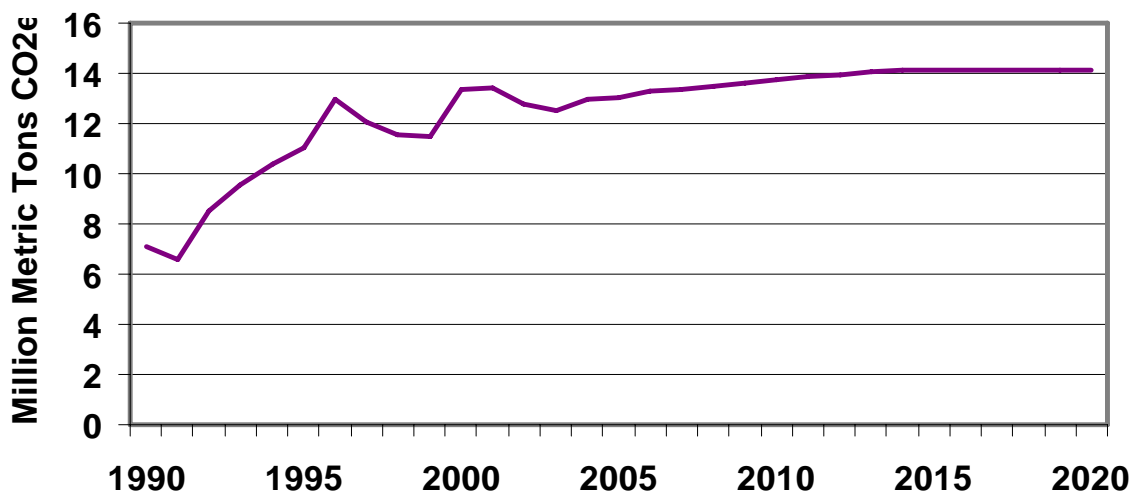
Figure 2-2. CO2 Emissions from Electricity Production in New Mexico, by Fuel Source



Fossil fuel industry emissions 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.¹⁰

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 2-3. GHG Emissions from Natural Gas Production and Processing



¹⁰ This 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 (Appendix C), increasing diesel use for freight transport is projected to account for nearly half of this growth (3.7 MMtCO₂e from 2000 to 2020). Increasing gasoline use would account for nearly as much growth (3.5 MMtCO₂e), driven largely by State population growth, while rising jet fuel use would account for the remainder (0.8 MMtCO₂e).

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

The result of these calculations is shown in 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. For the fossil fuel industry, emissions attributable to in-state use are only about one-third to one-quarter of total emissions produced. This ratio is so low because most of the emissions are related to natural gas production, and the State consumes only 1 BCF of gas for every 5 or 6 BCF it produces.

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

| (Million Metric Tons CO₂e) | 1990 | 2000 | 2010 | 2020 |
|--|--------------|--------------|--------------|--------------|
| Energy | 39.2 | 46.7 | 54.3 | 66.6 |
| <i>Electricity Use</i> | 15.8 | 19.7 | 21.4 | 26.4 |
| Transportation Fuel Use | 11.0 | 14.2 | 17.6 | 22.3 |
| <i>Fossil Fuel Industry</i> | 5.4 | 5.4 | 6.8 | 8.1 |
| 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 | 45.1 | 55.4 | 64.0 | 77.3 |
| <i>change relative to 1990</i> | | +23% | +42% | +72% |
| <i>change relative to 2000</i> | | | +16% | +40% |
| Forestry and Land Use | -20.9 | -20.9 | -20.9 | -20.9 |
| Net Emissions (incl. forestry) | 24.2 | 34.5 | 43.1 | 56.4 |
| <i>change relative to 1990</i> | | +43% | +78% | +134% |
| <i>change relative to 2000</i> | | | +25% | +64% |
| Per Capita Gross Emissions | 30 | 30 | 30 | 32 |
| Per Capita Net Emissions | 16 | 19 | 20 | 24 |

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.

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 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.¹¹ 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.¹² This is due to the large amount of rangeland cover present in NM. 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. If requested, CCS can prepare an inventory of black carbon emissions (both mass based and in CO₂ equivalents).

¹¹ We hope to correct changes attributable to definition changes in an revised inventory, but cannot estimate the effect of this change yet. This definitional issue relates to the large amount of rangeland in the state that is not covered by a carbon flux inventory unless it meets minimum forestland cover requirements.

¹² However, the carbon cycle for rangelands is not well understood, and has not been included in current surveys.

Table 2-4. Simplified Calculation of Consumption-Basis Emissions for Electricity and Fossil Fuel Production

| | 1990 | 2000 | 2010 | 2020 | units |
|---|-------------|-------------|-------------|-------------|----------------------|
| Electricity | | | | | |
| Electricity Produced (net of RPS) | 29 | 34 | 37 | 44 | TWh |
| In-State Electricity Needs (net of RPS) | <u>15</u> | <u>20</u> | <u>24</u> | <u>30</u> | TWh |
| <i>in-state share</i> | <i>54%</i> | <i>59%</i> | <i>64%</i> | <i>69%</i> | |
| Electricity Production Emissions | 29 | 33 | 33 | 38 | MMtCO ₂ e |
| Consumption-Basis Emissions | 16 | 20 | 21 | 26 | MMtCO ₂ e |
| Natural Gas | | | | | |
| Natural Gas Produced* | 965 | 1695 | 1604 | 1604 | BCF |
| In-State Gas Requirements* | <u>239</u> | <u>265</u> | <u>269</u> | <u>297</u> | BCF |
| <i>in-state share</i> | <i>25%</i> | <i>16%</i> | <i>17%</i> | <i>19%</i> | |
| Natural Gas Industry Emissions | 13 | 17 | 17 | 18 | MMtCO ₂ e |
| Consumption-Basis Emissions | 3.1 | 2.7 | 2.9 | 3.3 | MMtCO ₂ e |
| Oil | | | | | |
| Oil Produced | 52 | 69 | 64 | 64 | Million Barrels |
| In-State Oil Requirements | <u>41</u> | <u>47</u> | <u>60</u> | <u>73</u> | Million Barrels |
| <i>in-state share</i> | <i>79%</i> | <i>69%</i> | <i>93%</i> | <i>114%</i> | |
| Oil Production Emissions | 0.7 | 0.7 | 0.7 | 0.7 | MMtCO ₂ e |
| Consumption-Basis Emissions | 0.5 | 0.5 | 0.6 | 0.8 | MMtCO ₂ e |
| Oil Refined | 38 | 35 | 32 | 32 | Million Barrels |
| In-State Oil Requirements | <u>41</u> | <u>47</u> | <u>60</u> | <u>73</u> | Million Barrels |
| <i>in-state share</i> | <i>106%</i> | <i>137%</i> | <i>185%</i> | <i>226%</i> | |
| Oil Refinery Emissions | 1.6 | 1.6 | 1.6 | 1.6 | MMtCO ₂ e |
| Consumption-Basis Emissions | 1.7 | 2.2 | 3.0 | 3.6 | MMtCO ₂ e |
| Coal | | | | | |
| Coal Produced | 24 | 27 | 26 | 26 | million short tons |
| Coal Consumed | 15 | 17 | 18 | 20 | million short tons |
| <i>in-state share of coal consumption</i> | <i>62%</i> | <i>61%</i> | <i>67%</i> | <i>76%</i> | |
| <i>in-state share of elec consumption</i> | <i>54%</i> | <i>59%</i> | <i>64%</i> | <i>69%</i> | |
| Coal Mining Emissions | 0.2 | 0.2 | 0.7 | 0.7 | MMtCO ₂ e |
| Consumption-Basis Emissions | 0.1 | 0.1 | 0.3 | 0.4 | MMtCO ₂ e |

* Note that for consistency with natural gas consumption estimates, historical data for natural gas production shown are taken from the same source (US Energy Information Agency, marketed gas production). These numbers differ slightly from data compiled by the New Mexico EMNRD.

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 | 38.1 | |
| Coal | 28.0 | 30.7 | 30.4 | 34.5 | See electric sector assumptions in appendix |
| Natural Gas | 1.4 | 2.5 | 2.9 | 3.5 | |
| 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 (CH ₄ and N ₂ O) | 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) |
| SF ₆ 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. (CH ₄) | 2.3 | 3.5 | 4.1 | 4.4 | Dairy emissions grow with population |
| Agricultural Soils (N ₂ O) | 2.2 | 2.4 | 2.3 | 2.3 | No changes projected |
| Total Gross Emissions | 68.5 | 82.9 | 89.4 | 101.7 | |
| Forestry and Land Use | -20.9 | -20.9 | -20.9 | -20.9 | |
| Net Emissions (incl. forestry) | 47.6 | 62.0 | 68.5 | 80.8 | |