Appendix K Inventory and Quantification Methodology

K.1 Greenhouse Gas Emissions Inventory Methodology

K.1.1 Statewide Greenhouse Gas Emissions Inventory Reports

New Mexico currently has several existing GHG inventories; a 2020 report on 2005 and 2018 economy-wide emissions prepared by E3[1]; a 2022 report on 2020 emissions from the oil and gas sector prepared by ERG[2]; and a 2024 report on 2005 from the oil and gas sector by ERG[3] with future-year emission projections for 2025 and 2030. The existing GHG inventories were prepared using the best available information, including state-specific information when available.

E3 is currently in the process of updating New Mexico's GHG inventory with future-year emission projections. This updated inventory will include 2005 back-cast projections and 2021 emissions inventory with 2030 future-year business as usual (BAU) projections, 2050 BAU projections, 2030 control strategy projections, and 2050 control strategy projections. The final report for this inventory is expected to be available in May of 2024, however, preliminary emissions for 2021 have been included in Table 1 of this PCAP.

E3's estimates of emissions from the oil and gas industry in their report on 2005 and 2018 emissions have been replaced by estimates made by ERG in their reports on 2020 and 2005 emissions. ERG's reports are based on more specific state-level data than what was available at the time of E3's 2005 and 2018 estimates.

K.1.2 Calculation method by sector

Table K- 1 Summary of calculation methods by sector

Sector/Source	2005	2018	2021
Electricity Generation	**Based on emissions data for in-state electricity generation. Data sources include EPA and EIA**		**Preliminary: EPA State-Level Emissions Data**
Transportation	**Direct SIT outputs**	**Input EIA SEDS energy into LEAP with EPA SIT emission factors**	**EIA SEDS energy demand by fuel with emission factors from E3 (sourced from federal)**

[1] https://cnee.colostate.edu/wp-content/uploads/2021/01/New-Mexico-GHG-Inventory-and-Forecast-Report_2020-10-27_final.pdf
[2] https://service.web.env.nm.gov/urls/ktmiJzVo
[3] Report will be prepared by February 29, 2024

Sector/Source	2005	2018	2021
Residential Buildings	Direct SIT outputs	Input EIA SEDS energy into LEAP with EPA SIT emission factors	EIA SEDS energy demand by fuel with emission factors from E3 (sourced from federal)
Commercial Buildings	Direct SIT outputs	Input EIA SEDS energy into LEAP with EPA SIT emission factors	EIA SEDS energy demand by fuel with emission factors from E3 (sourced from federal)
Industry (Non-Oil and Gas)	Direct SIT outputs net fossil fuel industry fuel consumption	Input EIA SEDS energy into LEAP with EPA SIT emission factors after removing fossil fuel industry energy consumption	EIA SEDS energy demand by fuel with E3 emission factors after removing fossil fuel industry energy consumption
Agriculture		Direct SIT outputs (2018 data not available, assume same as 2017)	EPA State Level Emissions Data (IPCC Sector: Agriculture)
Coal Mining	Direct SIT outputs		EPA State Level Emissions Data (IPCC Sector: Energy. Subsector: Coal Mining)
Waste and Material Management	Direct SIT outputs		EPA State Level Emissions Data (IPCC Sector: Waste)
Oil and Gas Industry	2005 emissions are scaled from 2020 using oil production, gas production, and well counts. Assumptions are made on changes in control technology by basin based on	2020 emissions calculations are sector segment specific but were generally based on the NMED minor source emissions inventory, EMNRD well counts, U.S. EPA's GHGRP, U.S. EPA's GHGI, and U. S. EPA's NEI	

Sector/Source	2005	2018	2021
	the best available evidence.		
Land-Use, Land-Use Change, and Forestry (LULUCF) Sector Net Total	Direct SIT outputs	Direct SIT outputs (2018 data not available, assume same as 2017)	EPA State Level Emissions Data (IPCC Sector: LULUCF)

K.2 Quality Assurance Project Plan

A Quality Assurance Project Plan (QAPP) has been submitted to the U.S. EPA and is currently under review. A copy of the submitted QAPP is included in this PCAP as Appendix K.3.

K.3 Emission Reduction Quantification by Measure

K.3.1 Clean I-40 Transportation Corridor

K.3.1.1 Emission Reductions Estimate Method:

Planning for three transportation hubs to be built in New Mexico: one in Gallup, one in Albuquerque, and one in Tucumcari. Each transportation hub will include MDHV electric vehicle charging and/or H_2 refueling stations and on-site renewable energy generation and storage capacity. Each hub was based on planning done under the U.S. D.O.T.'s Regional Infrastructure Accelerator (RIA) grant. The RIA grant funded planning for transportation hubs in Albuquerque NM, Winslow AZ, and Kingman AZ.

It is assumed that the hubs in Gallup NM and Tucumcari NM will be the same size as the hubs in Winslow AZ and Kingman AZ.

GHG and CAP emission reductions are calculated with a combination of AFLEET, energy savings, and information from the RIA grant application.

K.3.1.2 Measure Implementation and Emission Reduction Estimate Assumptions:

The following key assumptions about the electric school buses' and chargers' component of this measure were used to quantify emission reductions for this measure:

- Each hub serves a mixture of vehicles:
    - Albuquerque NM:
        - 96 EV trucks per day at maximum utilization
            - 15% combo long haul
            - 25% combo short haul
            - 60% single unit short haul

        - 70 Hydrogen trucks per day at maximum utilization (all combo long haul)
        - 5.76 GWh year of solar energy production
    - Gallup NM:
        - 24 EV trucks per day at maximum utilization
            - 60% combo long haul (keeping the number of combo long haul EV units consistent between hubs)
            - 12% combo short haul
            - 28% single unit short haul
        - 70 Hydrogen trucks per day at maximum utilization (all combo long haul)
        - 19.98 GWh year of solar energy production
    - Tucumcari NM:
        - 24 EV trucks per day at maximum utilization
            - 60% combo long haul (keeping the number of combo long haul EV units consistent between hubs)
            - 12% combo short haul
            - 28% single unit short haul
        - 70 Hydrogen trucks per day at maximum utilization (all combo long haul)
        - 5.76 GWh year of renewable energy production
- Vehicle efficiency and VMT:
    - Combo long haul:
        - 170,000 miles/year
        - Deisel 7.2 MPGDE, EV 12.7 MPGDE, HFCV 7.9 MPGDE
    - Combo short haul:
        - 65,000 miles/year
        - Deisel 7.2 MPGDE, EV 12.7 MPGDE
    - Single unit short haul:
        - 16,500 miles/year
        - Deisel 6.5 MPGDE, EV 26.1 MPGDE
- Infrastructure:
    - EV charging and H_2 fueling infrastructure construction will be complete by January 1, 2027
    - Onsite renewable energy production construction will be complete by July 1, 2025
    - EV charging utilization will be 20% in 2027, 40% in 2028, 60% in 2029 and 80% in 2030. In 2031 and the following years utilization will be 100%.
    - EV charging will use renewable energy generated on-site and will produce no GHG emissions.
    - H_2 charging utilization will be 1% in 2027, 2% in 2028, 4% in 2029, 8% in 2030, 16% in 2031, 32% in 2032, 64% in 2033, and 90% in 2034. In 2035 and the following years utilization will be 100%.
    - H_2 used on site will have a decreasing carbon intensity over time:

- 15.6 CO_2e / kg H_2 in 2024, based on the average carbon intensity of H_2 produced from North American Fossil Natural Gas sold in California.
- 10 kg CO_2e / kg H_2 when the stations open in 2027, based on a linear decrease to
- 4 kg CO2e / kg H_2 in 2030, followed by a linear decrease to
- 0.45 kg CO2e / kg H_2 in 2050

K.3.1.3 Emission Reduction Calculations:

$$Aggregate\ GHG\ Reductions = EV\ Charging\ GHGs + HFCV\ Refueling\ GHGs + Renewable\ Energy\ GHGs$$

$$EV\ Charging\ GHGs = Trucks\ per\ day * GHG\ reduction\ per\ truck * Capex\ Ratio$$

$$HFCV\ Refueling\ GHGs = Trucks\ per\ day * GHG\ reduction\ per\ truck * Capex\ Ratio$$

$$Renewable\ Energy\ GHGs = Energy\ Production * Reference\ Case\ Emission\ Factor$$

$$Capex\ Ratio = \frac{Station\ Cost}{Station\ Cost + Unit\ Cost\ of\ Vehicle * Number\ of\ Vehicles\ simultaneously\ chargable}$$

K.3.1.4 Reference Case Scenario:

For vehicle emissions, the reference case is the utilization of diesel medium and heavy-duty vehicles for the same number of VMTs.

For renewable energy production, the reference case is the use of grid energy. The grid emissions factor used for this measure was 0.363 MT CO_2e/MWh, which is the emissions factor for the natural gas combined cycle, which produces the plurality of New Mexico electricity (Dept. of Energy).

K.3.1.5 Measure-Specific Activity Data and Implementation Tracking Metrics:

- Number and class of vehicles fueled
- Amount of electricity generated
- Amount of electricity used for charging EVs
- Amount of Hydrogen dispensed
- Amount, source, and carbon intensity of hydrogen delivered

K.3.1.6 GHG and CAP Emissions Reduced:

Implementation of this measure is anticipated to reduce 21,903 MT CO_2e per year with 86,458 cumulative $MTCO_2e$ for the period between 2025 – 2030, and 1,114,966 cumulative $MTCO_2e$ for the period between 2025 – 2050.

Implementation of this measure is anticipated to reduce 1,863 tons of NO_x, 15.8 tons of $PM_{2.5}$, 7.3 tons of SO_2, and 79.1 tons of VOC over the lifespan of the measure.

K.3.2 Clean Truck Incentive Program

K.3.2.1 Emission Reductions Estimate Method:

Emissions reductions for EVs and H_2 fuel cells were modeled using the AFLEET Tool in this measure, as were corresponding air quality impacts. For the electric vehicle charger and H_2 refueling station component of this measure, the percentage of capital expenditure measure was used to estimate resultant emissions reductions.

K.3.2.2 Measure Implementation and Emission Reduction Estimate Assumptions:

The following key assumptions about the electric school buses' and chargers' component of this measure were used to quantify emission reductions for this measure:

- Numbers of Equipment (midpoint of range):
    - Class 2b-3: 300
    - Class 4-6: 150
    - Class 7-8 EV: 50
    - EV Truck Class 2 Chargers: 200
    - EV Truck Class 3 150 kW Chargers: 250
- VMT:
    - Class 2b-3: 24,000 Miles/year
    - Class 4-6: 16,500 Miles/year
    - Class 7-8: 65,000 Miles/year
- MPGGE:
    - Class 2b-3 EV 44.6 MPGGE
    - Class 2b-3 Gasoline 13 MPGGE
    - Class 4-6 EV 26.1 MPGGE
    - Class 4-6 Diesel 6.5 MPGGE
    - Class 7-8 EV 14.3 MPGGE
    - Class 7-8 Diesel 4.5 MPGGE
- Annual GHG short tons CO_2e under GWP100
    - Class 2b-3 EV - 7.1
    - Class 2b-3 Gasoline - 21.8
    - Class 4-6 EV - 9.6
    - Class 4-6 - 34.9
    - Class 7-8 EV - 69.0
    - Class 7-8 Diesel - 198.9
- Vehicle Operating Lifetime 15 years

K.3.2.3 Emission Reduction Calculation:

The following equation was used to calculate GHG emission reductions from each class range of vehicles.

$$Truck_{GHG} = \#_T * (D_{GHG} - EV_{GHG}) * TL$$

$$Charger_{GHG} = \#_C * \#_{TS} * (D_{GHG} - EV_{GHG}) * \frac{\$C}{\$C + (\#_{TS} * \$T)}$$

Where:

$$Truck_{GHG} = Truck\ GHG\ Reductions\ for\ each\ class\ of\ vehicle$$

$$\#_T = Number\ of\ Trucks\ of\ each\ class\ subsidized$$

$$D_{GHG} = GHG\ emissions\ from\ a\ diesel\ vehicle\ of\ that\ class$$

$$EV_{GHG} = GHG\ emissions\ from\ an\ EV\ vehicle\ of\ that\ class$$

$$TL = Truck\ Lifetime$$

$$Charger_{GHG} = GHG\ emission\ reductions\ attriutable\ to\ the\ chargers$$

$$\#_C = Number\ of\ each\ charger\ type\ subsidized$$

$$\#_{TS} = the\ number\ of\ trucks\ served\ per\ charger\ (differs\ for\ Class\ 2\ and\ Class\ 3)$$

$$\$C = Cost\ of\ charger\ equipment\ and\ instalation$$

$$\$T = Cost\ of\ a\ Truck$$

K.3.2.4 Reference Case Scenario:

The reference case assumes that absent from the implementation of this measure the trucks replaced by this measure will be gasoline or diesel, not electric or hydrogen.

K.3.2.5 Measure-Specific Activity Data and Implementation Tracking Metrics:

- Planned and actual operating routes for trucks,
- Number/rate/character of truck routes,
- Number/rate/character of trucks added and removed from fleets, &
- Number/rate/character of vehicle miles traveled.

K.3.2.6 GHG and CAP Emissions Reduced:

Implementation of this measure is anticipated to reduce 14,867 MT CO_2e per year with 74,337 cumulative MTCO_2e for the period between 2025 – 2030, and 223,012 cumulative MTCO_2e for the period between 2025 – 2050.

Implementation of this measure is anticipated to reduce 200.1 tons of NO_x, 2.0 tons of $PM_{2.5}$, 1.8 tons of SO_2, and 26.9 tons of VOC over the lifespan of the measure.

K.3.3 ECO Schools

K.3.3.1 Emission Reductions Estimate Method:

GHG and CAP emissions reductions for electric school buses were modeled using the AFLEET Tool. For the electric vehicle charger component of the measure, a percentage of capital expenditure measure was used to estimate resultant emissions reductions. For the buildings component GHG and CAP emission reductions were modeled using projected energy savings and emissions savings based on the 2023 Innovative Energy Financing Projects Report by EMNRD.

K.3.3.2 Measure Implementation and Emission Reduction Estimate Assumptions:

The following key assumptions about the electric school buses and chargers component of this measure were used to quantify emission reductions for this measure:

- A school bus lifetime of 12 years
- 85 Electric School Buses
- 150 charging stations and ancillary equipment
- Average annual bus miles driven 15,000 miles per bus per year
- Diesel bus fuel efficiency of 22.5 MPDGE
- EV bus fuel efficiency of 7 MPDGE

The Socorro Consolidated School District was used as a prototype for what school districts could achieve through implementing the building component of this measure. The following key assumptions about the buildings component of this measure were used to quantify emission reductions for this measure:

- Building improvements at 10 school districts
- 329.5 kW DC solar PV installed per district
- 533 MWh/year electricity generation per district
- Annual financial savings of $154,856 / year per district
- Annual energy Savings of 31.9%
- Natural gas fuel savings of 425 MMBtu/year
- A New Mexico Grid Emissions Factor of 0.363 MT CO_2e /MWh
- A natural gas emission factor of 0.0531 MT CO_2e/MMBtu

K.3.3.3 Emission Reduction Calculation:

$$Bus\ GHG\ Reductions = \#\ of\ Buses * (Diesel\ GHG - EV\ GHG) * Bus\ Life$$

$$Charger\ GHG\ Reductions = \#\ of\ Chargers * (Diesel\ GHG - EV\ GHG) * Bus\ Life * \frac{Charger\ Cost}{(Charger\ Cost + Bus\ Cost)}$$

$$Solar\ PV\ GHG\ Reductions = Solar\ Generation * Grid\ Emission\ Factor$$

$$Building\ Retrofit\ GHG\ Reductions = Natural\ Gas\ Savings * Natural\ Gas\ Emissions\ Factor$$

K.3.3.4 Reference Case Scenario:

The reference case assumes that absent from implementation of this measure the school districts assisted by this measure continue to utilize diesel school buses, and do not access the ESCO program.

K.3.3.5 Measure-Specific Activity Data and Implementation Tracking Metrics:

The activity used to calculate actual GHG and CAP emission reductions from this measure will include:

- Annual VMT for each bus awarded
- Annual VMT of EV buses charged by charging stations awarded
- Grid energy savings at participating schools
- Natural gas energy savings at participating schools

K.3.3.6 GHG and CAP Emissions Reduced:

Implementation of this measure is anticipated to reduce 5,045 MT CO_2e per year with 25,227 cumulative MTCO_2e for the period between 2025 – 2030, and 103,300 cumulative MTCO_2e for the period between 2025 – 2050.

Implementation of this measure is anticipated to reduce 55.6 tons of NO_x, 0.3 tons of $PM_{2.5}$, 1.9 tons of SO_2, and 1.5 tons of VOC over the 12-year lifespan of the EV buses.

K.3.4 Community Mobility Opportunities

K.3.4.1 Emission Reductions Estimate Method:

Emission reductions from community mobility opportunities were estimated as a percentage reduction of current light-duty vehicle miles traveled.

K.3.4.2 Measure Implementation and Emission Reduction Estimate Assumptions:

The following key assumptions about this measure were used to quantify emission reductions:

- Light-duty vehicle miles traveled will be reduced by 5% by 2030
- Light-duty vehicle miles traveled will be reduced by 20% by 2050
- VMT reductions between 2026 - 2030 are linear
- VMT reductions between 2030 - 2050 are linear

K.3.4.3 Emission Reduction Calculation:

$$Cumulative\ emission\ reductions = \sum_{year} 2021\ Emissions * yearly\ \%\ VMT\ Reduction$$

K.3.4.4 Reference Case Scenario:

The reference case for the measure is current light-duty vehicle emissions. Current light-duty vehicle emissions are calculated based on transportation gasoline use in New Mexico in 2021.

K.3.4.5 Measure-Specific Activity Data and Implementation Tracking Metrics:

This measure can be tracked using gasoline sales in New Mexico.

K.3.4.6 GHG and CAP Emissions Reduced:

Implementation of this measure is anticipated to reduce 423,597 MT CO_2e per year with 1,270,790 cumulative MT CO_2e for the period between 2025 – 2030, and 23,086,025 cumulative MTCO_2e for the period between 2025 – 2050.

Implementation of this measure is anticipated to reduce 31,594 tons of NO_x, 828 tons of $PM_{2.5}$, 151 tons of SO_2, and 23,067 tons of VOC over the lifespan of the measure.

K.3.5 Methane Response Program

K.3.5.1 Emission Reductions Estimate Method:

The NM O&G GHGI, which estimated emissions for 2020, was used as the starting point to develop projected inventories for 2030. Projections for 2030 were estimated with and without emission reductions from the New Mexico state rules. The projected inventories reflect the impact that future increases in industry activity (oil and gas production) and current NM regulatory initiatives are expected to have on emission levels. The projected inventories do not include any emission reductions anticipated from the methane rules promulgated by the EPA: Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review (40 CFR Part 60).

K.3.5.2 Measure Implementation and Emission Reduction Estimate Assumptions:

Future Oil and Gas Activity and Production:
Projected year activity increase (A_x) estimates for 2030 were obtained from the US Energy Information Administration Annual Energy Outlook (AEO) 2023.[4] Separate estimates of A_x have been developed for crude oil production and natural gas production using the EIA data.

[4] US Energy Information Administration "Annual Energy Outlook 2023", March 16, 2023. https://www.eia.gov/outlooks/aeo/

Table K- 2 provides the production estimates and the 2030 projected inventory values of A_x for oil and gas production under the reference case.

Table K- 2 Oil and gas production for 2020 and estimates for 2030.

	2020	2030
Oil Reference Case Production (MMBL/day)	**11.28**	**13.31**
Oil Reference Case % Change From base year (A_x)	**0%**	**18%**
Gas Reference Case Production (trillion cubic feet)	**33.49**	**35.35**
Gas Reference Case % Change From base year (A_x)	**0%**	**6%**

The projected industry growth factors (A_x) in 2030 for either oil production or gas production were applied to the emissions for each emission source included in the inventory, based on the commodity most closely associated with emissions from that source. Table K- 3 describes the commodity used to scale each emission source, and what industry segment those sources are present in.

Table K- 3 Industry segment, Emission source, and the commodity used for scaling.

Industry Segment	Emission Source	Projections Commodity
G&B, Processing	Acid Gas Removal Units	Gas
Production	Associated Gas	Oil
G&B, Processing, Production, Transmission	Centrifugal Compressors	Gas
G&B, Processing, Production, Underground NG Storage	Combustion	Mix
G&B, Processing, Production, Underground NG Storage	Dehydrators	Gas
Transmission	Engine Combustion	Gas
G&B, Processing, Transmission, Underground NG Storage	Equipment Blowdowns	Gas
G&B, Processing, Transmission, Underground NG Storage	Equipment Leaks	Mix
Processing, Transmission, Underground NG Storage	Flares	Gas
Production	HF Completions	Mix
Production	HF Workovers	Mix
G&B, Production	High Bleed Pneumatic Controllers	Mix

Industry Segment	Emission Source	Projections Commodity
G&B, Production	Intermittent Bleed Pneumatic Controllers	Mix
Production	Liquids Unloading	Gas
G&B, Production	Low Bleed Pneumatic Controllers	Mix
Underground NG Storage	Metering and Regulating Equipment	Gas
G&B, Production	Miscellaneous Flaring	Mix
Production	Mud Degassing	Mix
Production	Non-HF Workovers	Mix
G&B, Transmission	Pipeline Blowdowns	Gas
G&B, Transmission	Pipeline Leaks	Gas
Abandoned Oil and Gas Wells	Plugged Abandoned Wells	Mix
Processing, Transmission, Underground NG Storage	Pneumatic Controllers	Gas
G&B, Production	Pneumatic Pumps	Mix
Production	Produced Water	Mix
G&B, Processing, Production, Transmission, Underground NG Storage	Reciprocating Compressors	Gas
Underground NG Storage	Storage Wells	Gas
Production	Tank Unloading	Mix
G&B, Production	Tanks	Mix
Transmission	Transmission Storage Tanks	Gas
Transmission	Turbine Combustion	Gas
Abandoned Oil and Gas Wells	Unplugged Abandoned Wells	Mix
Production	Well Pad Leaks - Gas - Wellhead	Gas
Production	Well Pad Leaks - Gas-Compressors	Gas
Production	Well Pad Leaks - Gas-Dehydrators	Gas
Production	Well Pad Leaks - Gas-In-line Heaters	Gas
Production	Well Pad Leaks - Gas meters/piping	Gas
Production	Well Pad Leaks - Gas-Separators	Gas
Production	Well Pad Leaks - Oil-Header	Oil
Production	Well Pad Leaks - Oil-Heater-Treater	Oil
Production	Well Pad Leaks - Oil-Separators	Oil
Production	Well Pad Leaks - Oil-Wellhead	Oil
Production	Well Testing	Mix

Emission Reductions:

VOC emission reductions were estimated for 20.2.50 NMAC (Oil and Gas Sector, Ozone Precursor Rules)[5] on an equipment type basis. An in-depth analysis was performed using detailed equipment counts from the 2020 CAP minor source emissions inventory, accounting for the applicability of 20.2.50 NMAC, the applicability of existing federal rules, and in-place controls. This analysis estimated overall VOC reductions expected as the requirements in the rule are fully implemented. Rule requirements for certain emission sources are phased in over time and will not be fully implemented until January 1, 2030. This analysis assumed that reductions are linear from January 1, 2023, to January 1, 2030. VOC reductions expected from the Part 50 rule were applied to CH_4 emissions in the projected inventories in those counties where the rule is applicable. As these reductions were estimated for the oil and gas industry overall (they are not segment-specific), they have been applied to each industry segment equally. No reductions are assumed for CO_2 emissions based on the Part 50 rule.

In addition to the NMED Part 50 rule, the New Mexico Department of Energy, Minerals, and Natural Resources (EMNRD) implemented a prohibition on the venting and flaring of associated gas (with some exceptions) through the "natural gas waste" rule.[6] The projected inventories for both CH_4 and CO_2 apply a 95% reduction in emissions from associated gas venting and flaring to account for this prohibition, which only allows venting or flaring under certain conditions.

Table K- 4 provides the estimated CH_4 reductions (*$Reductions_x$*) for affected emission sources for the 2025 and 2030 inventories based on the impacts of the Part 50 rule and the natural gas waste rule. Emission sources not shown in Table K- 4 were not assumed to have regulatory reductions in the projected inventories.

Table K- 4 Estimated 2030 CH_4 reductions by emission source.

Emission Source	2030 CH_4 Reduction (*$Reductions_x$*)
Engines	**5.6%**
Turbines	**36.5%**
Reciprocating and Centrifugal Compressors	**51.3%**
Equipment Leaks	**75.1%**
Liquids Unloading	**50.0%**
Dehydrators	**47.9%**
Hydrocarbon Liquids Transfers	**88.40%**
Pneumatic Controllers and Pumps	**90.6%**
Storage Tanks	**46.1%**

[5] Title 20, Chapter 2, Part 50 "Oil and Gas Sector – Ozone Precursor Pollutants" [20.2.50 NMAC 08/05/2022]
[6] Title 19, Chapter 15, Part 27 "Venting and Flaring of Natural Gas" [19.15.27 NMAC 05/25/2021]

Emission Source	2030 CH_4 Reduction (*$Reductions_x$*)
Associated Gas [a]	**95%**

[a] 95% reduction also applied for CO_2.

K.3.5.3 Emission Reduction Estimate Calculation:

The methodology used to develop the 2025 and 2030 projected inventories is as follows:

$$E_{2030} = E_{2020} \times (1 + A_{2030}) \times (1 - Reductions_{2030})$$

where:

E_{2030} = Projected emissions in year *2030*
E_{2020} = 2020 emissions
A_{2030} = Activity increase in year *2030* relative to 2020 (%)
$Reductions_{2030}$ = Emission reductions in year 2030 relative to 2020 (%)

Year 2025 and 2030 Results

Table K- 5 presents the results of the projected inventories for 2025 and 2030.

Table K- 5 Projected Inventory Estimates for the Oil and Gas Sector.

Year	Pollutant	Emissions (MT)	Change from 2020
2020	CH_4	547,212	NA
2020	CO_2	18,177,400	NA
2030 – with State rules	CH_4	250,261	-54%
2030 – with State rules	CO_2	19,242,501	6%
2030 – without state rules	CH_4	598,009	9%
2030 – without state rules	CO_2	20,022,348	10%

K.3.5.4 Reference Case Scenario:

The reference case for this scenario is production increases under normal market scenarios with no state rules.

K.3.5.5 Measure-Specific Activity Data and Implementation Tracking Metrics:

GHG emission reductions from this measure can be tracked with VOC emissions as a proxy using the National Emissions Inventory (NEI) and NMED minor source emissions inventories.

K.3.5.6 GHG and CAP Emissions Reduced:

Implementation of this measure is anticipated to reduce 10,169,050 MT CO_2e per year with 41,947,333 cumulative MT CO_2e for the period between 2025 – 2030, and 245,328,339 cumulative MT CO_2e for the period between 2025 – 2050.

Implementation of this measure is anticipated to reduce 120,950 tons of NO_x, and 524,356 tons of VOC over the lifespan of the measure.

K.3.6 Pre-Weatherization for Low-Income New Mexicans

K.3.6.1 Emission Reductions Estimate Method:

The emissions reductions were calculated by estimating the number of homes that would receive pre-weatherization assistance and the number of homes that would receive heat pumps calculating the associated annual fuel savings per home.

K.3.6.2 Measure Implementation and Emission Reduction Estimate Assumptions:

The major assumption for this measure was the average cost of a pre-weatherization renovation. Based on data from the Mortgage Finance Authority's existing Weatherization Readiness Program's costs for structural remediation, an estimation of $18,000 per home was made. Pending additional data received, this value can be updated accordingly. Parameters related to annual fuel savings and GHG savings of weatherization were sourced from the New Mexico Mortgage Finance Authority, and can be found in the table below:

Table K- 6 Pre-weatherization Activity Parameters.

Parameter	Unit	Value
Cost of Pre-Weatherization per Home	$/dwelling	$18,000
Annual GHG abatement from weatherization, per home	MT CO_2e	1.56
Annual Fuel Savings per home from weatherization	MMBtu	29.3
Annual Fuel Savings from Heat Pump	MMBtu/dwelling/year	29.5
Natural Gas Emissions Factor	MT CO_2e/MMBtu	0.0531

Assumptions were made around the percentage of homes that received pre-weatherization work that went on to weatherize and receive building electrification work: 90% of homes were assumed to go on to weatherize, and 22% were assumed to receive a heat pump installation. It was also assumed that 25% of weatherization emissions reductions can be attributed to pre-weatherization work.

K.3.6.3 Emission Reduction Calculation:

Aggregate GHG Reductions = [Number of Homes * (% of Homes that Weatherize * GHG savings from Weatherization + % of Homes that receive HPs * GHG savings from HPs)] * % attributed to pre-weatherization work

K.3.6.4 Reference Case Scenario:

The reference case scenario assumes no pre-weatherization or retrofit improvements were conducted.

K.3.6.5 Measure-Specific Activity Data and Implementation Tracking Metrics:

MFA uses an online reporting and invoicing system that requires partners to enter details of each unit completed before payment. The completed unit data is captured for each partner and shows the projected energy savings in MMBTUs and dollars.

Before the start of any unit, the agencies upload photos, estimated costs, and descriptions of the project. MFA either approves these projects or asks for more information from the service provider before approval.

In addition to having the ability to view what projects are complete and the funding used, MFA regularly follows up with the service providers to determine the status of approved units, and when they are scheduled for full weatherization. MFA runs reports on a monthly and quarterly basis that show the number of homes that have been approved, received the first layer of readiness services, and fully weatherized homes. All homes that receive pre-weatherization or repairs through this program are expected to be fully weatherized.

K.3.6.6 GHG and CAP Emissions Reduced:

Implementation of this measure is anticipated to reduce 389 MT CO_2e per year with 1,946 cumulative MT CO_2e for the period between 2025 – 2030, and 9,730 cumulative MT CO_2e for the period between 2025 – 2050.

Implementation of this measure is anticipated to reduce 8.6 tons of NO_x, 0.5 tons of SO_2, and 0.1 tons of VOC over the lifespan of the measure.

K.3.7 CEED Block Grant Program

K.3.7.1 Emission Reductions Estimate Method:

GHG emission reductions are based on natural gas and grid energy savings due to retrofits.

K.3.7.2 Measure Implementation and Emission Reduction Estimate Assumptions:

To estimate upfront capital costs for building shell upgrades, data from the New Mexico Mortgage Finance Authority's weatherization program was used. For annual fuel and

GHG savings from building shell upgrades, data from NM EMNRD was used. While all dwellings targeted by this measure will receive building shell upgrades, it was assumed that only 30% of dwellings receive heat pump installations as part of a building electrification package. This assumption was made because a significant segment of homes will require an electric panel upgrade before receiving a heat pump.

Table K- 7 Community Energy Efficiency Activity Parameters.

Parameter	Unit	Value	Source
Building Shell Upgrade Cost, per home	$/dwelling	$7,400	NM MFA
Ducted Air-Source Heat Pump Cost, per home	$/dwelling	$14,500	NM MFA
Annual Fuel Savings from Shell Upgrade	MMBtu/dwelling/year	29.3	NM EMNRD
Annual GHG Savings per Building Retrofit	MT CO_2e/dwelling/year	4.4124	NM EMNRD
Annual Fuel Savings from Heat Pump	MMBtu/dwelling/year	57.5	E3 Estimate
Natural Gas Emissions Factor	MT CO_2e/MMBtu	0.0531	EPA
Additional GHG savings from Heat Pump	MT CO_2e/dwelling/year	3.05	Calculation

With regards to the completion of the 5,500 energy efficiency retrofits, it was assumed that after an initial outreach and planning year, the number of retrofits would ramp up each year, reaching a rate of 1,000 per year after 3 years of retrofit implementation. This is based on previous construction rates of the New Mexico WAP program and the need to train and build up the workforce to complete these retrofits. The annual retrofit deployment schedule can be found below:

Table K- 8 Community Energy Efficiency Retrofit Schedule.

Year	Annual Retrofits	Cumulative Retrofits
2025	0	0
2026	200	200
2027	500	700
2028	800	1,500
2029	1,000	2,500
2030	1,000	3,500
2031	1,000	4,500
2032	1,000	5,500

K.3.7.3 Emission Reduction Calculation:

Aggregate GHG Reductions = Building Retrofit GHG Reductions + Heat Pump GHG Reductions

Heat Pump GHG Reductions = Energy Saved from Heat Pump * Natural Gas Emissions Factor

K.3.7.4 Reference Case Scenario:

The reference case scenario for this measure assumes no retrofits were conducted.

K.3.7.5 Measure-Specific Activity Data and Implementation Tracking Metrics:

The following metrics will be followed to indicate the success of the implementation of this program:

- Number of residences reached, identified, and qualified by the end of each quarter.
- Number of residences receiving retrofit work by the end of each quarter.
- Number of residences with completed retrofit work by the end of each quarter.
- Final number of residences with completed retrofit work by the end of the implementation period.

K.3.7.6 GHG and CAP Emissions Reduced:

Implementation of this measure is anticipated to reduce 10,169,050 MT CO_2e per year with 41,947,333 cumulative MT CO_2e for the period between 2025 – 2030, and 245,328,339 cumulative MT CO_2e for the period between 2025 – 2050.

Implementation of this measure is anticipated to reduce 120,950 tons of NO_x, and 524,356 tons of VOC over the lifespan of the measure.

Outcomes – This measure will result in combined emissions reductions **of 39,429.8 metric tons of CO_2e by 2030** and a total of **305,847.4 metric tons of CO_2e reduced by 2050**. In terms of air quality impacts, the measure is expected to reduce the following pollutants by 2050: **NH_3 by 1 metric tons, NO_x by 114 metric tons, PM2.5 by 0.5 metric tons kg, and SO_2 by 6 metric tons**.

K.3.8 Integrated and Wholistic Low-Income and Disadvantaged Buildings Sector Incentive Programs

Greenhouse gas emissions reduction calculations are pending Phase II CPRG coalition formation.

K.3.9 Clean and Resilient Energy for Local Government

K.3.9.1 Emission Reductions Estimate Method:

Benefits and co-benefits will be assessed once the details of the multistate coalition are finalized. Greenhouse gas emissions and criteria emissions reductions will be calculated based on a case evaluation using the National Renewable Energy Lab's PVWatts and ReOpt Tools, and data from projects that have received New Mexico's Solar Market Development Tax Credit.

K.3.9.2 Measure Implementation and Emission Reduction Estimate Assumptions:

For the evaluated case, a 387 kW rooftop solar installation with 60 kW battery power and 153 kWH battery capacity is assumed. GHG emissions reductions will be calculated as follows based on the funding allocated to each state in the multistate coalition:

K.3.9.3 Emission Reduction Calculation:

$$2025 - 2030\ Cumulative\ GHG\ Reductions\ (MT) \leq 0.7 * \left(\frac{Non\ Admin\ Funding}{817{,}154}\right) * 237 * 5$$

$$2025 - 2050\ Cumulative\ GHG\ Reductions\ (MT) \leq 0.7 * \left(\frac{Non\ Admin\ Funding}{817{,}154}\right) * 237 * 25$$

$$NO_x\ Annual\ Emission\ Reductions\ (MT) \leq 0.17 * \left(\frac{Non\ Admin\ Funding}{817{,}154}\right)$$

$$SO_2\ Annual\ Emission\ Reductions\ (MT) \leq 0.17 * \left(\frac{Non\ Admin\ Funding}{817{,}154}\right)$$

$$PM_{2.5}\ Annual\ Emission\ Reductions\ (MT) \leq 0.01 * \left(\frac{Non\ Admin\ Funding}{817{,}154}\right)$$

K.3.9.4 GHG and CAP Emissions Reduced:

Implementation of this measure is anticipated to reduce 6,091 MT CO_2e per year with 30,453 cumulative $MTCO_2$e for the period between 2025 – 2030, and 152,266 cumulative $MTCO_2$e for the period between 2025 – 2050.

Implementation of this measure is anticipated to reduce 156 tons of NO_x, 9.2 tons of $PM_{2.5}$, and 156 tons of SO_2 over the lifespan of the measure.

K.3.10 Organic Waste Diversion

K.3.10.1 Emission Reductions Estimate Method:

All greenhouse gas (GHG) emissions for this measure used the EPA WARM Tool, which was also used to calculate labor for the South Central Waste Authority's strategy.

K.3.10.2 Measure Implementation and Emission Reduction Estimate Assumptions and Calculations:

Assumptions and step-by-step calculations for diversion quantities for each strategy follow:

<u>South Central Solid Waste Authority (Dona Anna County and the City of Las Cruces)</u>
Based on current operations, it is assumed that this measure could divert 3,500 tons per year of green waste between 2025 and 2030. This amount represents an estimate of the material currently being collected and landfilled from our 8 community collection centers, located in Dona Ana County.

GHG Reductions: 1,111 MTCO2E/ 5 years

<u>Los Alamos County</u>

Based on a recent food composting feasibility study conducted by SCS Engineers, it was determined that Los Alamos is estimated to divert 1,500 tons of food scraps and 3,000 tons of yard trimmings annually. These numbers include food scraps and yard trimmings from all businesses and residential households including schools, grocery stores, restaurants, households, and the national laboratory. Using the EPA Warm tool, we calculated emissions avoided for 1,500 tons of food scraps and 3,000 tons of yard trimmings over 5 years.

GHG Reductions: 3,483 MTCO2E/ 5 years

Santa Fe County

The average number of meals served at Santa Fe County Senior Centers between 2013 and 2016 was 28,741.75 per year. With an estimated .55 lbs of food waste generated per meal, total food waste estimates for Santa Fe County Senior Centers are 7.9 tons/year. The Santa Fe County Detention Center's food waste estimates are 60.225 tons/year based on the EPA's 2019 Wasted Food Report of 1.1 lbs of food waste generated per inmate per day and around 300 inmates present at the Detention Center throughout the year. Cumulated food waste estimates utilized for annual GHG emission estimates were 68.125 tons/year or 340.625 tons/5 years. These estimates were calculated to result in a reduction of 23.8 MTCO2E/year and 119 MTCO2E over five years. GHG emissions were calculated using the EPA WARM tool.

Food Waste Diverted: 68.125 tons * 5 = 340.625 tons (2025-2030)

GHG Reductions: 23.8 MTCO2E/year; 119 MTCO2E/ 5 years

The City of Albuquerque

Residential Project

Background: WRI's residential campaign study results showed a 20% reduction in food waste (though there are challenges to that number as well); USDA estimates that 290 pounds of food is wasted per capita per year, which means the program could reduce up to 58 pounds (0.029 tons) of food waste per person per year. Using census data for the average household size in Albuquerque of 2.32 people and a project reach of 2,000 households (across two communities), that is a reach of 4,640 people. Impact: 135 tons per year. For the GHG calculation, using the EPA WARM tool for composting (a conservative calculation since the reduction will be through prevention, which has a higher GHG reduction value) for 138 tons yields 15.95 MTCO2E reduction for the year after implementation (7.98 MTCO2E per campaign).

Assumptions: 100% of the potential GHG reduction for the first year after each campaign (July to the following June), 75% for the following year (assuming 25% revert to old practices), and 40% for each subsequent year (assuming half the people who wanted to take part adopt life-long waste reduction habits); (found 0 studies to reference, so used conservative numbers). Community 1 distribution was completed before October 2025 and community 2 before January 2026.

Food Waste Prevented: 135 tons in the first year after implementation.

GHG Reductions: 15.95 MTCO2E for the first year after implementation.

2025-2030 GHG Calculation: GHG = 47 = 7.98+0.75*7.98+7.98*0.4*3 [campaign 1] + 7.98+0.75*7.98+7.98*0.4*3 [campaign 2]

2025-2050 GHG Calculation: GHG = 177 = 7.98+0.75*7.98+7.98*0.4*23.75 [campaign 1] + 7.98+0.75*7.98+7.98*0.4*22.75 [campaign 2]

Restaurant Project

Background and Assumptions: Workshops: quarterly, each on a different topic, free to chefs and kitchen staff from small, local restaurants. Technical assistance: 5 restaurants, at least 3 located in or primarily serve EJ communities (i.e., LIDAC tracts). Background: NRDC estimated restaurant employees generate 3,000 lbs (1.5 tons) of food waste per employee per year (see page 118 https://www.nrdc.org/sites/default/files/food-waste-city-level-technical-appendices.pdf). The project will support composting, food repurposing, and food donations among several small, local restaurants (about 100 employees total, an average of 20/restaurant—you will need to ask restaurants interested in participating how many staff they have and change this number accordingly) for 40 weeks (first 12 weeks of the 1-year project are devoted to restaurant onboarding and assessment). Based on the City and County of Denver's Department of Public Health & Environment case study results, which saw at least 90% of restaurant food waste with technical assistance (see slide 11 for link), 90% of food waste is expected to be prevented/diverted at each of the participating restaurants. The estimated project impact of diverting 104 restaurant tons will be diverted due to project implementation. This is calculated by taking: 1) 1.5 tons per employee year x 100 employees divided by 52 weeks = 2.88 tons weekly estimated food waste; 2) 2.88 tons x 90% waste diversion = 2.9 tons diverted weekly; 3) 2.9 tons x 40 weeks = 104 tons. Using the EPA WARM tool for composting (a conservative calculation since a significant portion will be prevented or rescued, which have higher GHG reduction values) for 104 tons yields 12.02 MTCO2E for 1st year. Project replicated for Y2. Caveats: This calculation does not consider things they might already be doing to reduce food waste. Also, we are not adding in the GHG reduction from the workshops. Different restaurants will be supported each year for three years. Estimate 50% of potential GHG reduction during the implementation year since restaurants will be learning; 100% of potential for the next year; 50% for the following 4 years; and 30% for all subsequent years (found 0 studies to reference, so used conservative numbers).

Food Waste Prevented/Diverted: 104 tons in the first year after implementation.

GHG Reductions: 12.02 MTCO2E for the first year after implementation.

2025-2030 GHG Calculation: GHG = 108.2 = 12.02*.5+12.02+12.02*.5*4 [impacts of 1st year] + 12.02*.5+12.02+12.02*.5*3 [impacts of 2nd year]
12.02*.5+12.02+12.02*5*2 [impacts of 3rd year]

2025-2050 GHG Calculation: GHG = 332 = 12.02*.5+12.02+12.02*.5*4+12.02*.3*20 [impacts of 1st year] + 12.02*.5+12.02+12.02*.5*4+12.02*.3*19 [impacts of 2nd year]
12.02*.5+12.02+12.02*.5*4+12.02*.3*18 [impacts of 3rd year]

Community Composting Project
Background and Assumptions: Based on Lancaster Community Composting Co-ops, where 186 members diverted on average 35.325 pounds of food waste per household each month. each site can serve about 75 households and divert up to 33,750 lbs (16.88 tons) of food waste each year (based on interviews with Lancaster staff) and 5.57 tons of browns each year (estimated at ⅓ of food waste weight based on Lancaster white paper), diverting a total of 22.45 tons of material. Using the EPA WARM Tool and entering the browns as leaves, it is estimated to sequester 2.25 MTCO2E per site annually. Plan: Construct 7 new sites in 2025 and hire a coordinator to help the systems get up and running and then transition them to more independent running (or permanently fund the position). Used 2.25 MTCO2E for the calc. Emission reductions are based on the assumption that all sites will be operational by July 2025 (½ year for 2025), and all sites would sustain 2.25 MTCO2E/site for the full duration (after implementation) since all 7 will be operational for that time.

Organic Material Diverted: 16.88 tons of food waste +5.57 tons of green waste annually = 22.45 tons of material per year.

GHG Reductions: 2.25 MTCO2E for the first year after implementation.

2025-2030 GHG Calculation: GHG = 87 = (2.25*7*.5)+2.25*5*7

2025-2050 GHG Calculation: GHG = 402 = 7*2.25*0.5+7*2.25*25