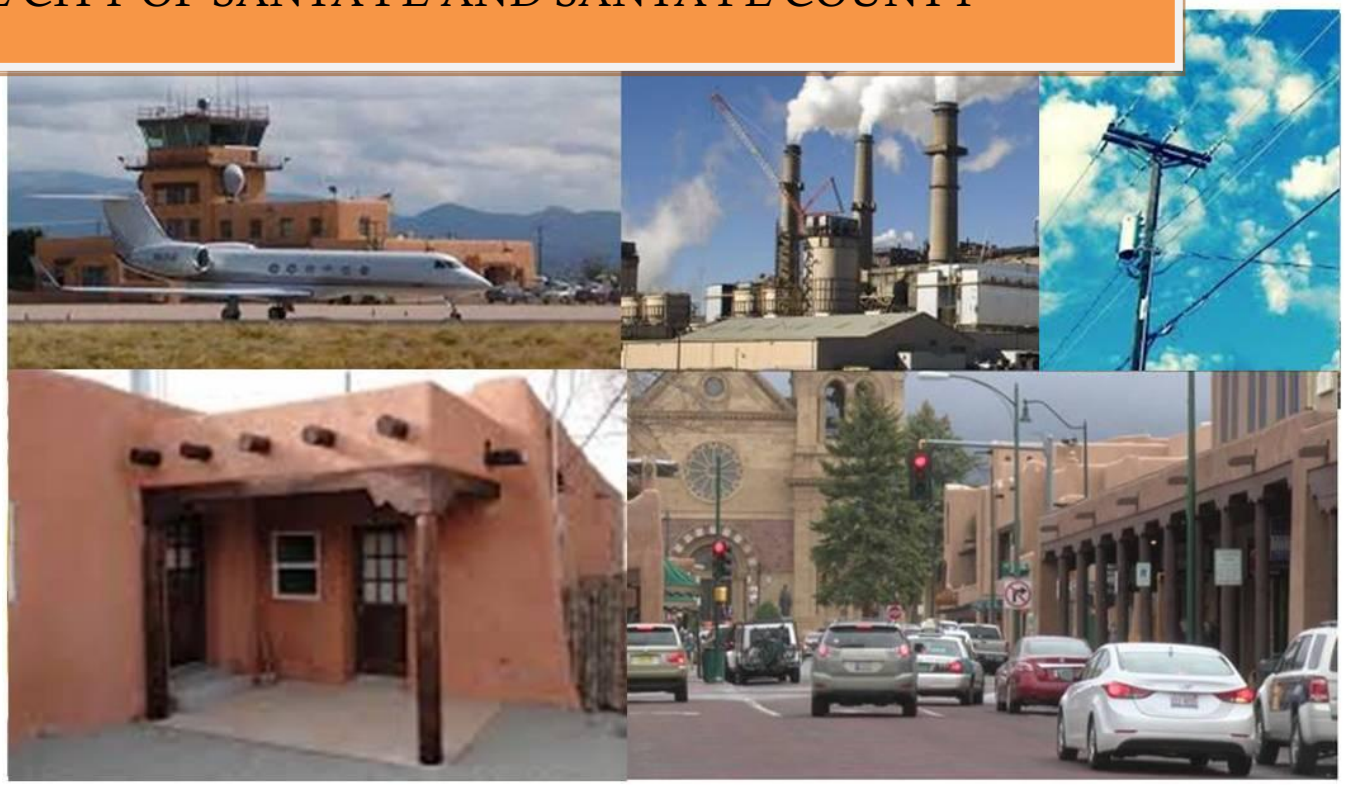
2015 GHG EMISSIONS INVENTORY
THE CITY OF SANTA FE AND SANTA FE COUNTY



This document was prepared for the Sustainable Santa Fe Commission

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Executive Summary

The City of Santa Fe seeks to achieve carbon neutrality by 2040 in a way that not only reduces greenhouse gas (GHG) emissions but also significantly alleviates poverty, supports a thriving economy, and ensures a sustainable environment. To reach these goals, the Sustainable Santa Fe Commission (SSFC) is developing a comprehensive 25 Year Sustainability Plan.

The Climate Working Group, on behalf of the SSFC, developed a greenhouse gas emissions inventory for Santa Fe and nearby communities, in accordance with the standards of measurement adopted by the Compact of Mayors. The Compact of Mayors is a global coalition of cities committed to addressing climate change, which the City of Santa Fe joined in 2015.

The following inventory uses the Global Protocol for Community Scale GHG Emissions (WRI, ICLEI, and C40 Cities 2014), hereafter referred to as the GPC. Due to data availability, the close geographic proximity and economic ties to neighborhoods and towns outside of the City of Santa Fe, the inventory estimates emissions from three nested geographic areas: Santa Fe County, the Santa Fe Metropolitan Planning Area (MPA), and the City of Santa Fe.

The GPC emphasizes standards for conducting an inventory that is primarily territorial-based. This means that the emissions are those that are produced within the geographic boundaries of the chosen jurisdictions. The notable exception is electricity, which is usually generated outside of the jurisdiction boundaries, but is included since it is a significant emissions source.

The inventory, comprising sector by sector data from the year 2015, is shown in the figure below.

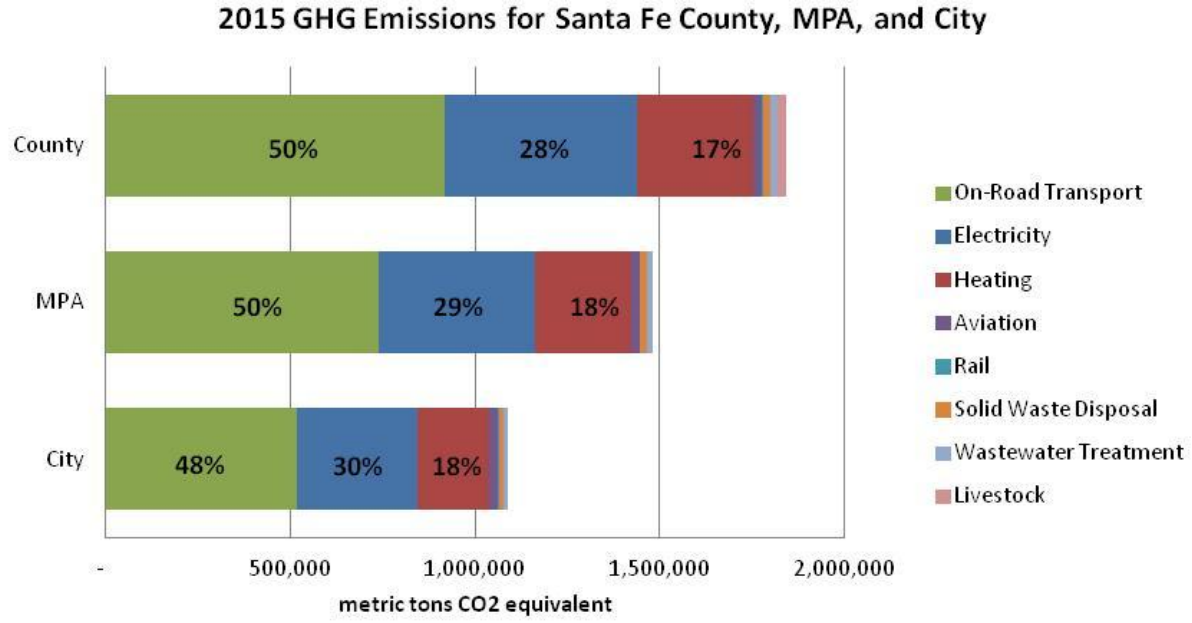

Figure 1: Territorial GHG Emissions for Santa Fe County, Metropolitan Planning Area (MPA), and City for 2015

The figure above reveals that the largest emission sectors come from on-road transportation (48-50%), followed by electricity (28-30%), and heating (17-18%) in the three nested jurisdictions. Stated another way, buildings

(heating and electricity) and transportation are responsible for about 96% of the territorial GHG emissions for the City, MPA, and County.

Additional sectors considered, including aviation, rail, wastewater, solid waste, and livestock (all contributing about 1%) are small in magnitude relative to the primary contributors. However, when it comes to enacting carbon mitigation policies or projects, every sector must be carefully scrutinized to identify where the lowest hanging fruit resides, in terms of the mitigation costs and co-benefits for projects or policies.

It can be alluring to compare per capita emissions between locations. However, per capita emissions can give relatively little insight into the actual emission footprints of residents when using a territorial-based inventory. For example, the per capita emissions for Santa Fe County residents are 12.4 tCO2/person, well below the per capita emissions of New Mexicans at 34 tCO2/person in 2013[1], and even of the United States average (17.3 tCO2/person[2]). However, critical factors influencing a community's territorial-based per capita emissions include climate, intensity of industry, generation portfolio of local utilities, urban density, and wealth, which can have large variance across communities.

Suggestions for improving data quality

It is important to highlight some of the issues involved in the data collection. While we feel confident that our estimations are representative of the actual emissions from different sectors, we did need to use estimation techniques where data was lacking. From a planning perspective, having well quantified emissions is essential for evaluating the impacts of mitigation projects and policies. Every planning choice has costs and benefits. The better we understand the true outcomes of policies and projects, not just future estimations, the better we will be able to direct our community's development towards a more sustainable path. Below are several suggestions for fine-tuning our carbon accounting:

- On-road transportation is the largest emissions sector. NM Department of Transportation (DOT) has generously provided county-level daily vehicle miles travelled (DVMT) for our emissions estimations, based on traffic counters in both the city and county. NM DOT is willing to provide DVMT for both the County and the City, coupled with a breakdown of DVMT by vehicle class, in the future, helping to improve the emission estimations. In addition, the NM Taxation and Revenue department currently posts only a percentage of gasoline tax revenue[3], making it difficult to estimate total sales volumes. Availability of both gasoline and diesel sales and quantity information in the City and County would serve to validate the fuel estimates derived from DVMT.

- Current estimations of residential and commercial electricity consumption are derived from historical data from 2010 coupled with current electricity revenue data. Ideally, the City, County, and public utility (PNM) will be able to form an agreement that will result in sharing of more direct and detailed commercial and residential consumption. This is critical for better analyzing impacts of community wide energy efficiency initiatives.

[1] https://www.env.nm.gov/aqb/GHG/documents/NM_GHGInventory_2013_Update.pdf
[2] https://en.wikipedia.org/wiki/List_of_U.S._states_by_carbon_dioxide_emissions#cite_note-EPA-1
[3] http://www.tax.newmexico.gov/combine-fuel-tax-distribution-reports-cft.aspx

- We did not feel comfortable making emissions estimation for land use changes given the information that we found available. Using USDA and forestry data, we provide estimations of current carbon stocks in the various ecologies in Santa Fe County. In the future, it will be useful to form a partnership with the forest service and agricultural departments to develop an understanding of changing carbon fluxes due to forest management, forest fires, human development, and agricultural changes within the city and county.

- Emission from food, goods, and services were based on estimates derived by researchers from household and income characteristics within the County. Due to the large impact that food consumption choices have on emissions, it may be useful to base future emission estimations on local consumption data. The easiest approach may be to invite food distributors to participate in an annual survey that would reveal purchases or inventory turnover in several food categories.

Recommendations for mitigating emissions

Cities that have already successfully reduced their GHG emissions through various policies can be a source of best practices for Santa Fe in its path to becoming carbon neutral. For example, New York City has considerably reduced its emissions via a shift in its production of electricity away from coal and towards renewables[4]. Los Angeles is set to phase out coal produced electricity by 2025. This is a national trend that would greatly impact electricity-based emissions in New Mexico.

For Santa Fe and other cities in New Mexico, substantial emission reductions in the electricity sector would have to be coordinated with utilities, such as PNM, which still has a substantial component (55%) of coal-generated electricity in its portfolio. Increasing energy efficiency, such as lighting and mechanical efficiencies and smarter automation can help reduce electrical loads, while wider-scale adoption of residential and commercial photovoltaics and other decentralized renewable generation can help to offset grid emissions. Education and outreach may help increase awareness of heating and electricity efficiency programs that are currently run by the electricity and gas utilities.

Targeting reductions from on-road transportation is critical, as it is currently the largest source of emissions. Transportation emissions can be reduced by decreasing travel demand, increasing vehicle efficiencies, and switching to lower-carbon fuels. Santa Fe's low population density is a critical barrier to decreasing travel demand and increasing the cost effectiveness of public transport. It is critical that the City and County continue to re-evaluate existing building and zoning codes and incentives to support higher density development and more mixed-used affordable housing along critical transportation corridors with the goal of decreasing commutes and increasing the viability of public transport, ride sharing, biking, and walking.

Electric cars and other low emission vehicles will also offer a path to reduce emissions from transportation. However, electric vehicles are currently only accessible to wealthier households, and the effectiveness of electric vehicles at reducing GHG emissions is tied to reducing the emissions associated with grid electricity. The City should consider what policies it can develop that will encourage the adoption of more fuel efficient vehicles.

Most importantly, if the City and County want to link carbon neutrality and sustainable community development, emissions reductions must be tied to an understanding of the impacts that carbon-reduction projects and policies

[4] http://www.nyc.gov/html/planyc/downloads/pdf/NYC_GHG_Inventory_2014.pdf

will have on quality of life and economy, especially for its most vulnerable populations; the so-called climate-poverty nexus. Carbon mitigation projects that have a range of co-benefits in areas of poverty alleviation, equity, economic development, job creation, and environmental protection must be prioritized.

An essential step towards deep GHG reductions is having an emissions inventory and a refined data collection process that will help planners better understand current emissions, and monitor emission reductions and co-benefits resulting from policies and projects.

1. Introduction

This document provides an estimation of greenhouse gas (GHG) emissions for the City of Santa Fe, Santa Fe County, and the Santa Fe Metropolitan Planning Area (MPA). The methods of estimation seek to follow the Global Protocol for Community Scale GHG Emissions (WRI, ICLEI, and C40 Cities 2014), hereafter referred to as the GPC. The GPC is a standard protocol required for all cities signed on to the Compact of Mayors. The Compact of Mayors, which Santa Fe signed in 2015, commits the City to conducting an inventory of GHG emissions, which will be updated annually. The inventory establishes a benchmark of emissions in the areas of energy, transportation, waste, and several other sectors, and will be used to develop and update a 25 Year Sustainability Plan for Santa Fe.

The GPC classifies emissions as Scope 1, 2, or 3. Scope 1 emissions refer to those that are emitted within the City boundary (or other designated area), Scope 2 emissions are those occurring as the result of electricity, heating, steam, or other cooling demands, even if they are generated outside of the City, and Scope 3 are all other emissions that might occur outside of the chosen boundary as a result of choices or actions occurring within the boundary. The following figure illustrates the how the different Scopes might overlap within an inventory boundary.

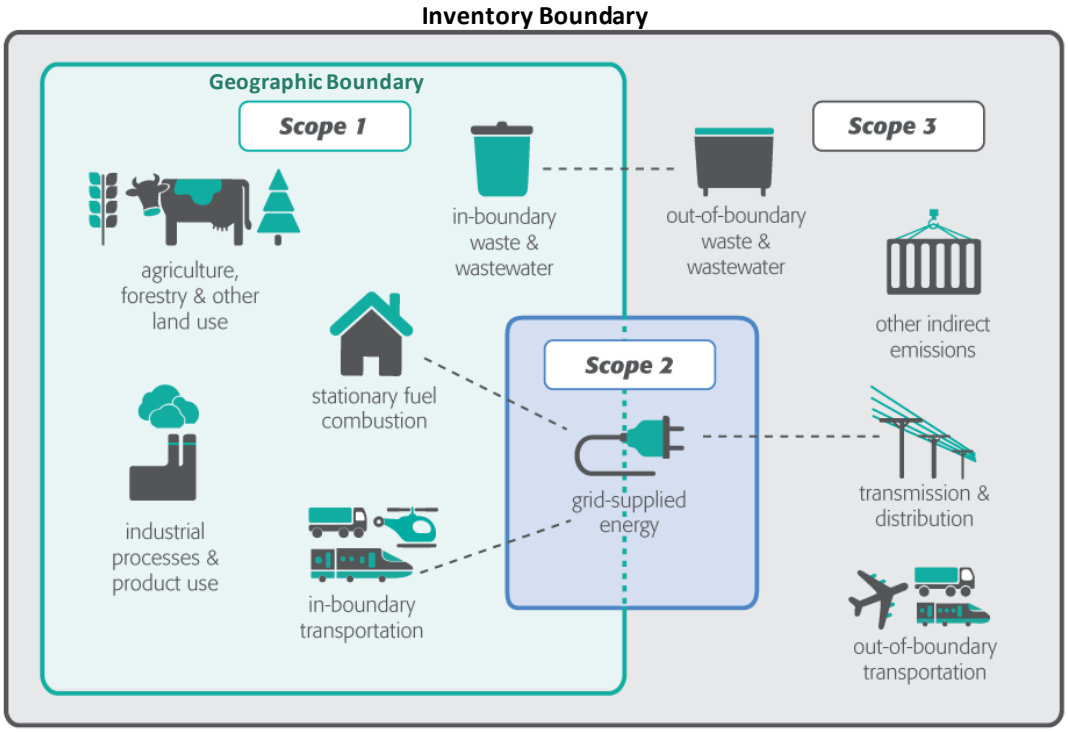

Figure 2: Definition of Scope 1, 2, and 3 emissions, used in the GPC accounting scheme (WRI, ICLEI, and C40 Cities 2014)

The inventory and data presented in this document emphasize Scope 1 and Scope 2 emissions, and may be interpreted as primarily a territorial-based GHG inventory, with the inclusion of grid-supplied electricity.

Box 1: Production versus Consumption-Based GHG Inventories

A territorial (also referred to as a production-based inventory) measures emissions that are produced, or originate within a given geographic boundary. A territorial-based emissions inventory accounts for all goods and services taking place within the territory, even if they are then exported. A territorial-based inventory doesn't account for emissions that result from imports (such as manufactured goods or food), which are produced outside of the territory, yet driven by demand within the territory.

In contrast, a consumption-based inventory attempts to account for all emissions that result from goods or services that are consumed within a particular geographic area, regardless of where they are produced. A consumption-based inventory therefore accounts for locally produced goods and imports, but doesn't account for emissions that are produced within the inventory boundary but exported.

If all geographic boundaries on the globe complete a territorial-based inventory or they all complete a consumption-based inventory, both inventories should be complete and equal. Santa Fe, like most communities, is currently focused on a territorial-based inventory (while also including the emissions of electricity generation and transmission), primarily because it allows for easier accounting. However, due to the magnitude and potential for reduction by behavior changes, it is also important to highlight emissions associated with the production and import of food and goods.

Although Scope 3 emissions aren't required in the GPC inventory, awareness of the impact of these emissions is an important part of developing a comprehensive carbon mitigation plan. Unlike Scope 1 and Scope 2 emissions, which rely more heavily on regulatory, market, or technology changes, Scope 3 emissions highlight the impact that individual purchasing choices can make. Below are estimates of Scope 3 emissions of food, goods, and services for Santa Fe County, carried out by researchers at UC Berkeley (C. M. Jones and Kammen 2011; C. Jones and Kammen 2014). These emission estimates were developed by first creating average US emission factors for categories of food (meat, dairy, fruit and vegetables, etc), goods (entertainment, clothing, household goods, etc.), and services (health care, entertainment, education, etc.). Using these generic emission factors the researchers then derived emissions per household for different zip codes, scaling the emissions by using US Census values for family income and household size.

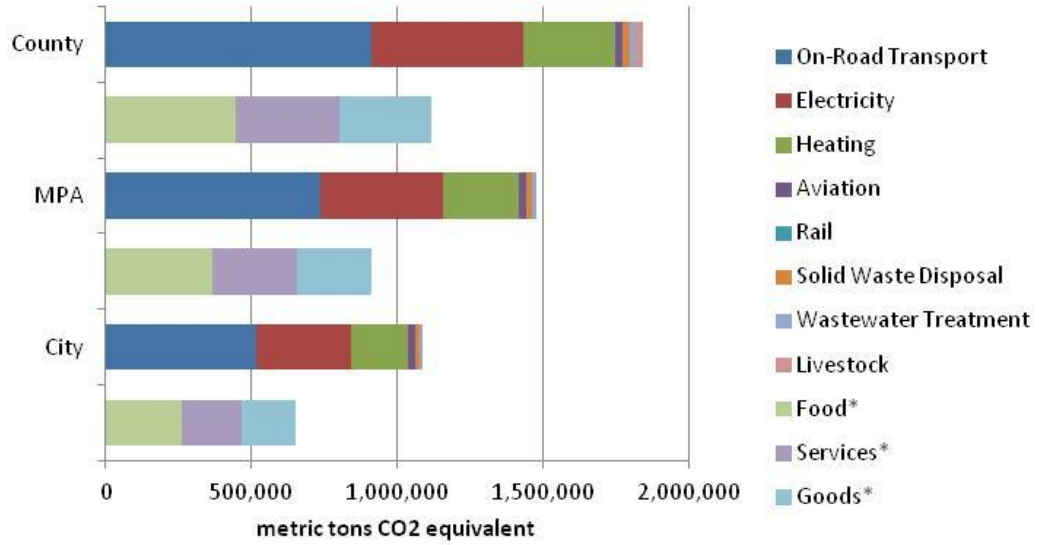

Figure 3: Territorial GHG Emissions for Santa Fe County, Metropolitan Planning Area (MPA), and City for 2015, with additional estimations for GHG emissions based upon the geographic area consumption of food, services, and goods.

This figure highlights the importance of keeping in mind the scale of consumption-based emissions when considering carbon mitigation pathways. The carbon emissions resulting from choices about food, goods, or services, have large contributions to our community's carbon footprint. For example, the estimated emissions from these three categories are equal to 60% of the emissions from the other sectors. It may be much easier for a family to reduce emissions through different food purchase choices than from reducing emissions from their transportation or electricity use.

2. Geographic and Demographic Community Overview

Due to data availability, the close geographic proximity and economic ties to neighborhoods and towns outside of the City of Santa Fe, this GHG emissions inventory estimates emissions in three geographic areas: Santa Fe County, the Santa Fe Metropolitan Planning Area (MPA), and the City. The MPA includes the City of Santa Fe and all proximate communities, but excludes some of the larger and more distant towns in Santa Fe County, such as Edgewood. The figure below shows the geographic boundaries for these three jurisdictions.

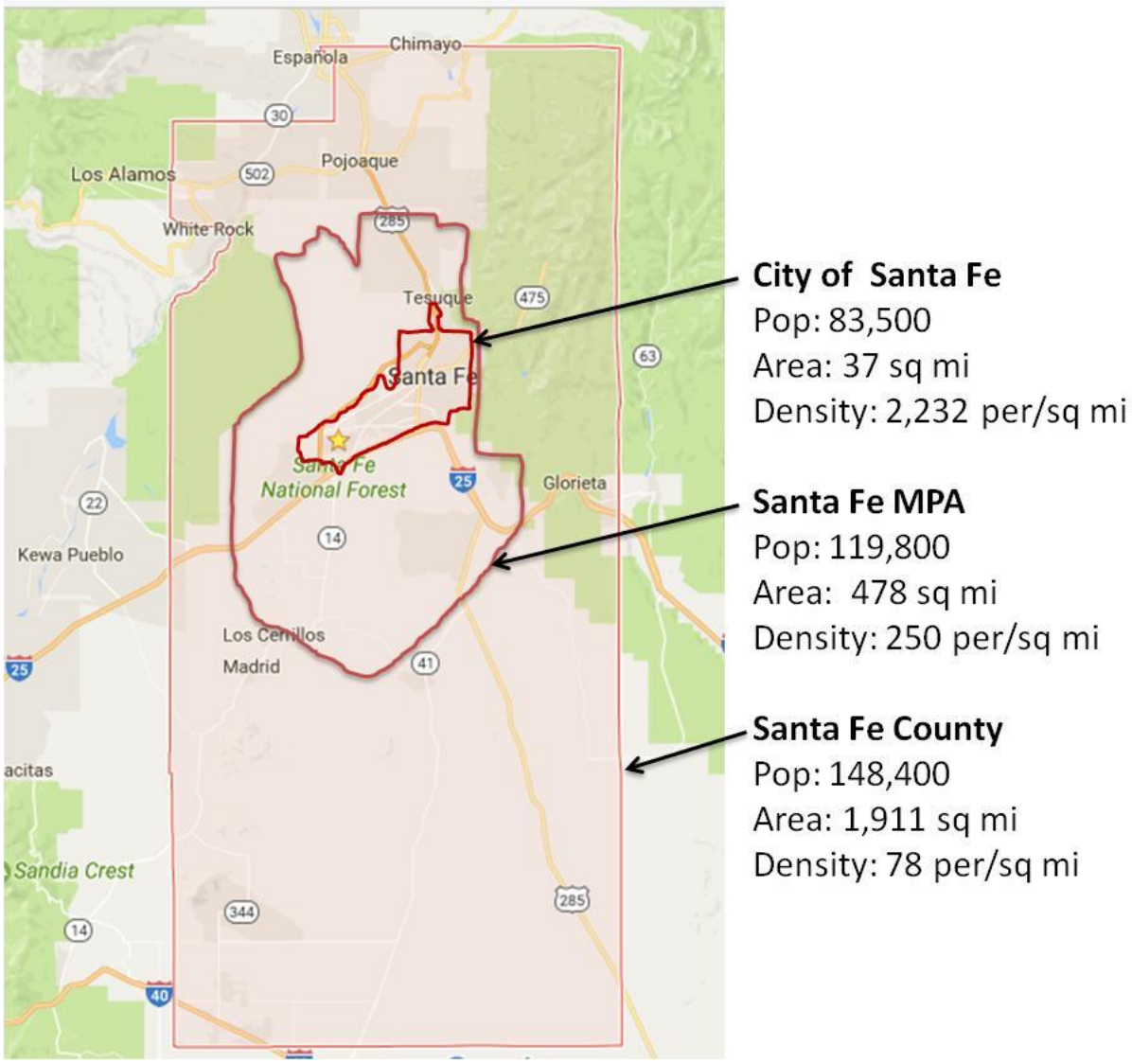

Figure 4: Map of the City of Santa Fe, Santa Fe Metropolitan Planning Area (MPA), and Santa Fe County

The table below shows the projected population growth for these three geographic areas through 2040.

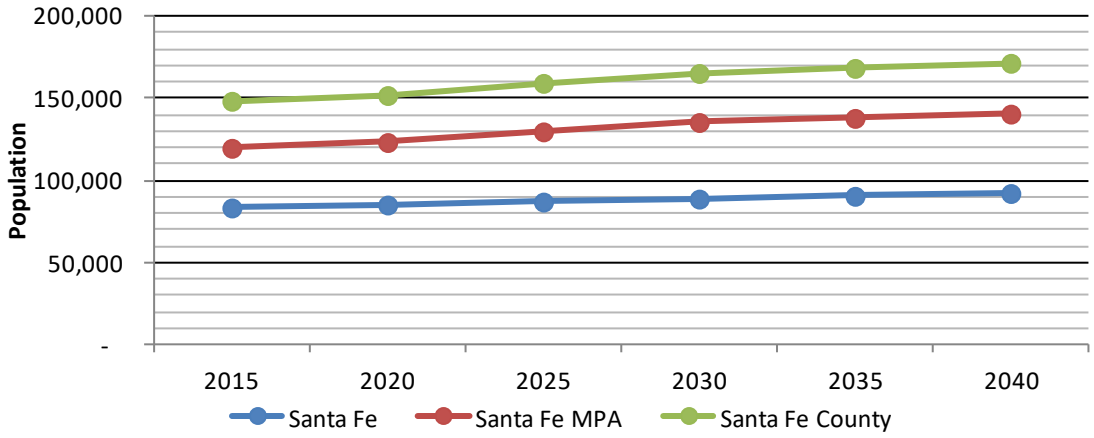

Figure 5: Projected population growth for Santa Fe, Santa Fe County, and Santa Fe Metropolitan Planning Area (MPA) through 2040. Source: (Santa Fe MPO 2015). Population growth is derived from U.S. Census Bureau and UNM Bureau of Economic Research estimates.

The relatively low population density of the City and County pose challenges for sustainable transportation, water use, and energy consumption, all of which tend to increase in efficiency as density increases. In 2015, the average density for the City of Santa Fe was 2,232 persons per square mile, which is 9 times denser than the MPA and 29 times denser than the County. For comparison, the City of Albuquerque is about 33% denser than the City of Santa Fe.

Tourism plays an important role in Santa Fe's economy, and will have seasonal impacts on emissions from transportation, waste, and heating and electricity. However, based on numbers from the City's tourism department, it is unlikely that tourists create a population increase greater than 10% of Santa Fe's population base, as seen in the figure below.

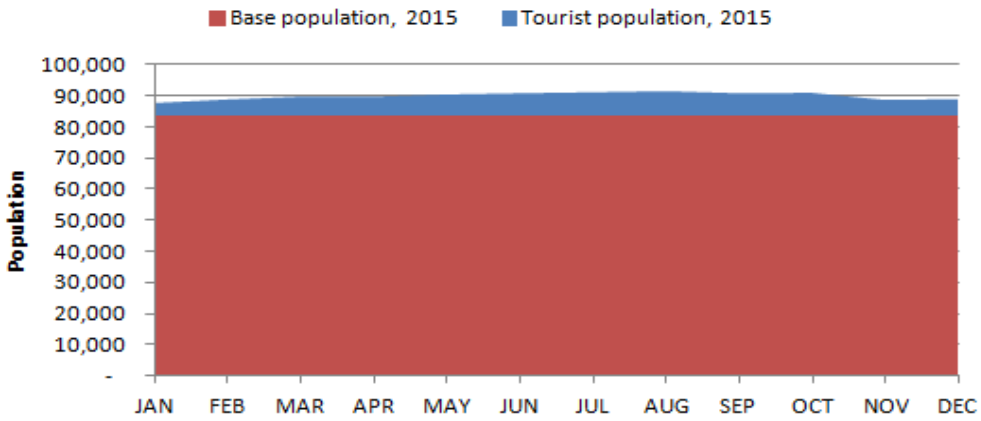

Figure 6: Estimated impact of tourism in 2015 on base population of 83,500 for City of Santa Fe. Estimation of tourism population based on hotel occupancy rates by month, provided by City of Santa Fe, from a total of 5,200 rooms and 1.8 people per room.

3. Stationary Energy

Stationary energy comes from heating and electricity and comprises almost half of all GHG emissions for the City, County, and MPA. Most heating and electricity are utilized inside of buildings. The figure below shows the contributing proportion of stationary energy to total emissions. The inset box in the right of the figure shows how heating and electricity use in the County are divided between commercial and residential use. While a smaller proportion of electricity is used in residences (45%), the majority of heating is used in them (62%).

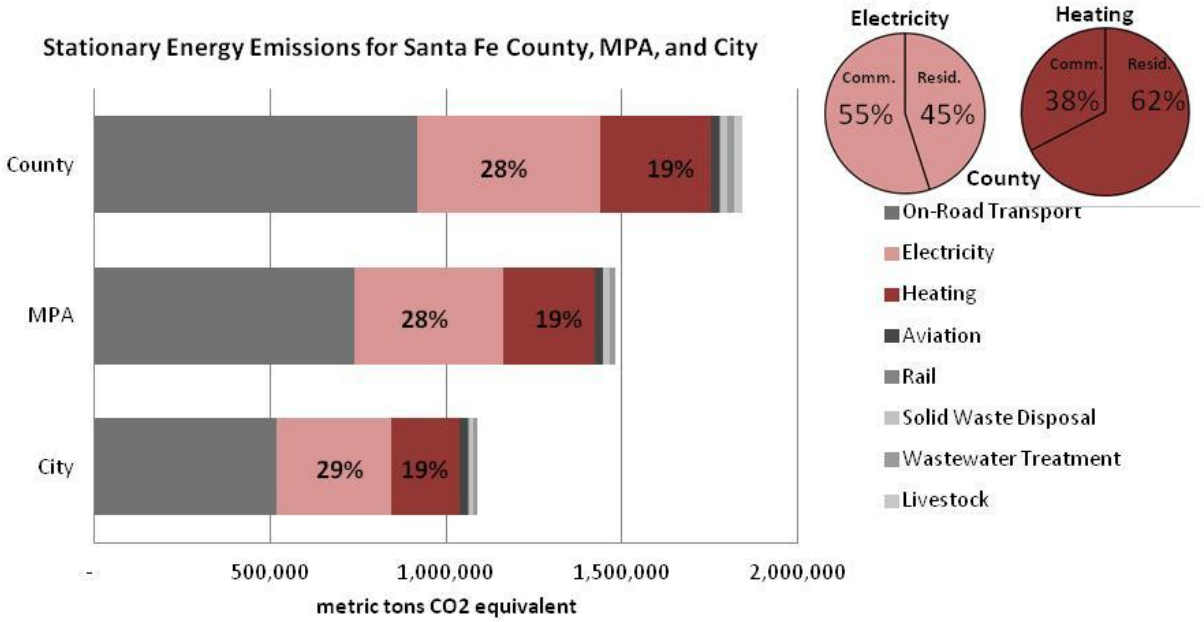

Figure 7: Emissions from Electricity and Heating for the County, MPA, and City of Santa Fe, 2015. Inset box shows breakdown of heating and electricity consumption in the County by commercial and residential use.

Electricity

The City of Santa Fe and Santa Fe County fall within the electricity service territory of PNM, an Investor Owned Utility (IOU), and the largest electricity service provider in New Mexico. Emissions within the electricity sector are driven by PNM's reliance on coal electricity production. The figure below shows the breakdown of sources of electricity for all power consumed on PNM's electricity grid for 2015, whether or not the electricity was generated or purchased by PNM. The emissions from PNM's coal generation (54% of total energy) is partiallly offset by the large contribution of nuclear generation (29%). The emission factor for PNM's grid for 2015 was estimated to be 0.60 kgCO2/kWh of electricity, which is about equal to the emissions factor for pure natural gas generation.

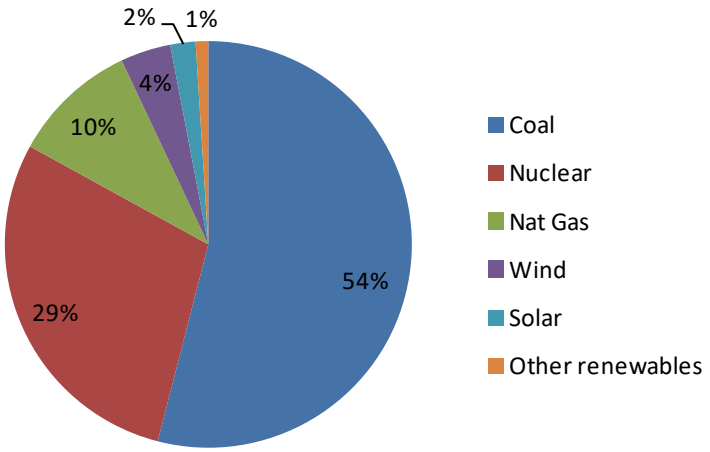

Figure 8: Composition of electricity consumed from PNM's grid, 2015, including electricity both generated and purchased by PNM (Source: Estimation derived from emission factor communicated by staff, and data available in PNM annual reports)

The last date of publicly available residential and commercial electricity consumption released by PNM to the City of Santa Fe was in 2010. Electricity consumption within the City, MPA, and County for 2015 was therefore estimated based upon revenue reported to the County as well as the historical trends in breakdown between residential (44%) and commercial (56%)[5] consumption. Monthly estimates of commercial and residential consumption for 2015 are shown in the figure below.

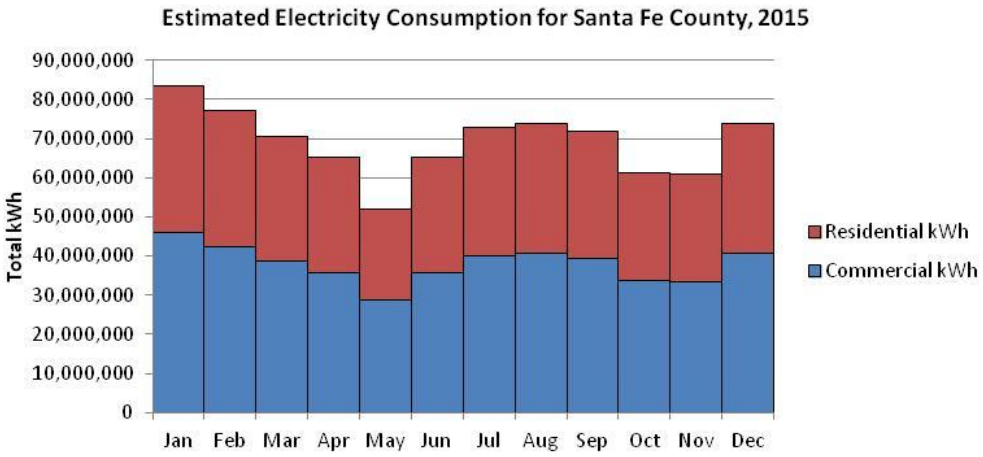

Figure 9: Estimated electricity consumption for Santa Fe County, commercial and residential, for 2015. Calculations based on estimations derived from 2015 gross receipts[6] and 2010 residential/commercial consumption patterns.

Below is a summary table, using the 2015 estimates of electricity consumption in the County to scale the data to the City and MPA, and calculate total metric tons of CO2 equivalent emissions.

[5] Industrial consumption in Santa Fe County has historically been close to 0.1% of total electricity consumed

[6] Electricity gross receipts (under Santa Fe County, Utilities): http://www.tax.newmexico.gov/monthly-rp-80-reports-gross-receipts-by-geographic-area-and-6-digit-naics-code.aspx

2015 Estimation	Residential (kWh/yr)	kWh/Home	Commercial (kWh/yr)	kWh/Firm	Total (tCO2e)
Santa Fe City	216,663,105	6,087	297,832,493	24,026	324,599
Santa Fe MPA	304,293,918	6,087	366,751,467	24,026	423,509
Santa Fe County	372,421,670	6,087	455,182,041	24,026	522,141

Table 1: Estimated electricity use and CO2 emissions for the City of Santa Fe, MPA, and Santa Fe County for 2015. Total tCO2e include estimation of transmission and distribution loss. Number of households used in the estimate were 35,592, 49,987, and 61,179, respectively, and the number of firms (from 2010 US Census Survey, interpolated for MPA) were 12,396, 15,264, and 18,945, respectively.

Box 2: PNM's Electricity Grid

Final ruling on the Obama Administration's Clean Power Plan is still pending. Under the rule, emissions from fossil fuel burning power plants in the state of New Mexico would need to be reduced by 32% below 2012 levels by 2030, reducing statewide average emissions from 0.82 kgCO2/kWh to 0.52 kgCO2/kWh[7]. PNM's Integrated Resource Plan (IRP), released in 2014, provides a range of scenarios for its electricity portfolio, up to the year 2034[8]. Most scenarios in the plan show an emission factor in 2034 of about 0.46 kgCO2/kWh (which is about 30% below its 2012 emission factor of 0.66 kgCO2/kWh, and 23% below its current emissions factor of 0.60kgCO2/kWh). Therefore, if PNM followed the reference case outlined in the IRP, CO2 emissions from the electricity sector in Santa Fe (and within the PNM service territory) would decrease by about 25% by 2034. If the City and County aspire to achieve greater carbon reductions than those in PNM's portfolio, then two economically favorable levers of change include energy efficiency and installation of residential and commercial photovoltaic (PV) systems. Both options can achieve cost and electricity savings. Although there are now a number of financing options for residential installations that can provide less than 10 year financial payback times, as of 2016, about 1,000 PV systems have been installed on residential and commercial rooftops in Santa Fe[9].

Heating

The majority of heating in the City, for both residential and commercial users, comes from natural gas that is distributed through a network of pipes, owned and operated by New Mexico Gas Company. Homes and businesses in rural areas typically rely on tanks or bottles of propane for heating and cooking. The table below shows the home heating fuels used within Santa Fe County and the City of Santa Fe, as estimated by the U.S. Census:

[7] https://www3.epa.gov/airquality/cpptoolbox/new-mexico.pdf
[8] PNM's IRP can be found here: https://www.pnm.com/irp-process
[9] https://openpv.nrel.gov/index

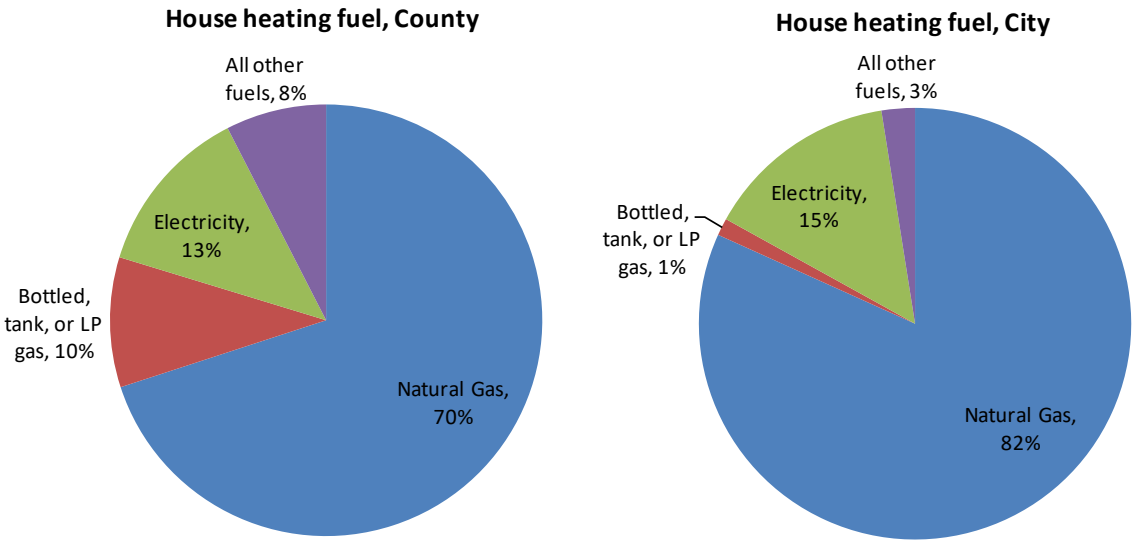

Figure 10: 2015 Santa Fe County and City house heating fuels (US Census Bureau 2015)

The consumption values provided by New Mexico Gas Company cover the Santa Fe service area and some customers in nearby metro areas, and were used to calculate a per household and per firm consumption rate. This value was then scaled to the City, MPA, and County, given the percent of users that use natural gas or propane, which has a similar emission factor. Below is a summary table with the energy consumption rates (in units of therms) as well as the total metric tons of CO2 equivalent emissions.

2015 Estimation	Residential (therms/yr)	therms/Home	Commercial (therm/yr)	therms/Firm	Total (tCO2e)
Santa Fe City	22,365,339	758	14,708,493	1,187	197,102
Santa Fe MPA	30,748,065	758	18,112,065	1,187	259,764
Santa Fe County	36,820,649	758	22,479,220	1,187	315,267

Table 2 Estimation of CO2 emissions for the City of Santa Fe, MPA, and Santa Fe County, from use of natural gas for heating. Number of households and firms used in the estimate are the same as reported in Table 1.

Box 3: Energy and Heating Breakdown in the City of Santa Fe

Least cost reductions in emissions for both electricity and heating often comes from energy efficiency initiatives (e.g., LED lighting, building automation, improved insulation, etc.). The following figure shows a breakdown of electricity and heating consumption within the City of Santa Fe. City facilities, which include everything from government owned buildings, to street lighting, to mechanical pumps for the water division, account for about 6% of total electricity consumed from PNM (about 20% of the City's electricity comes from photovoltaic (PV) systems, not included since this chart is only consumption from PNM). When City facilities, public schools, and state buildings are subtracted from commercial use, residential and commercial become almost equal in terms of electricity consumption. Residential is the largest consumer of natural gas for heating.

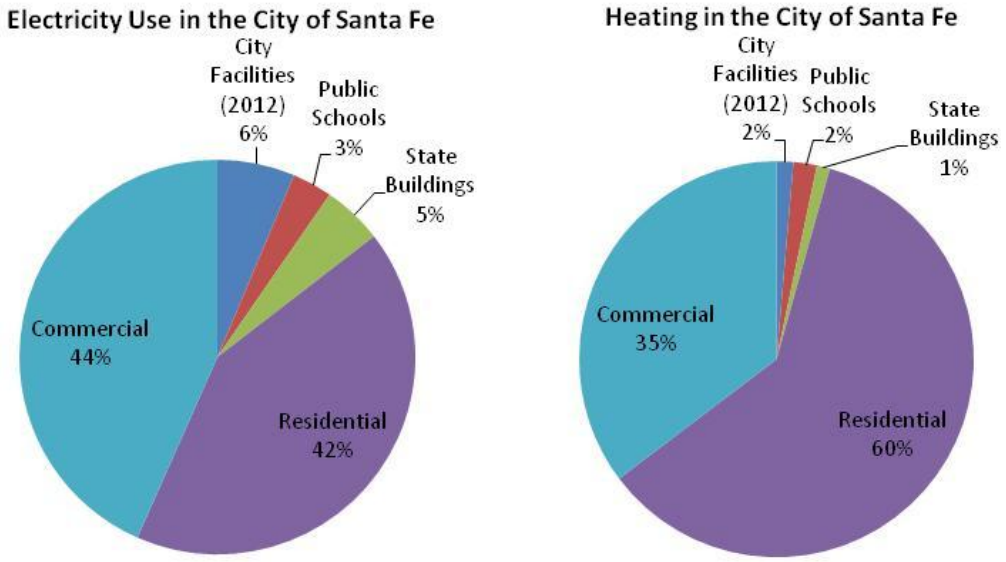

Figure 11: Percent breakdown of electricity and heating use in the City of Santa Fe for 2015. 33 City facilities, having a combined area of 765,000 sqft, had per unit energy consumption of 29 kWh/sqft for electricity and 0.07 mmBTU/sqft for heating. Public schools: 2.7 million sq ft, 6 kWh/sqft, 0.03 mmBTU/sqft. State Buildings: ~ 1.5 million sqft, 17 kWh/sqft, 0.03 mmBTU/sqft. Sources: City of Santa Fe Water Division, Santa Fe Public Schools Energy and Water Conservation Program Coordinator, NM ENMRD.

4. Transportation

The GPC suggests a range of options for calculating emissions from the transportation sector depending upon the availability and resolution of data. This report utilized a territorial method that quantifies emissions from transportation activity occurring solely within geographic boundaries, regardless of the trip's origin or destination. This model aligns with Scope 1 emissions, as all in-boundary transportation is included. As can be seen from the figure below, on-road transportation comprises the largest single emission source, while aviation and rail are relatively small components of overall emissions.

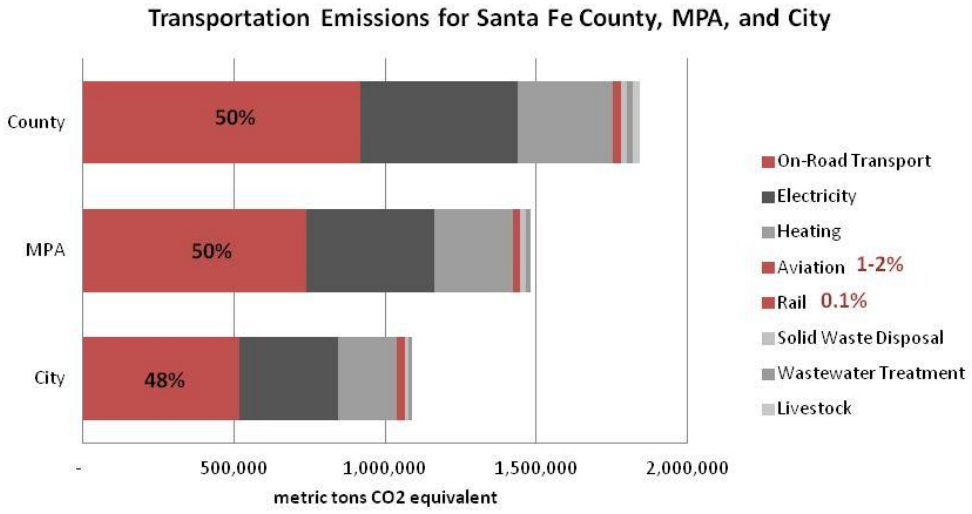

Figure 12: 2015 transportation emissions for Santa Fe County, MPA, and City

On-road transportation

On-road transportation makes up the single largest emission source for the City of Santa Fe, MPA, and County. The mean travel time to work is 19 minutes in the City and 22 minutes for the County (US Census Bureau 2015). The figure below shows that the vast majority of people (75%) drive alone as their primary means to get to work, while only 1% use public transportation in both the City and County.

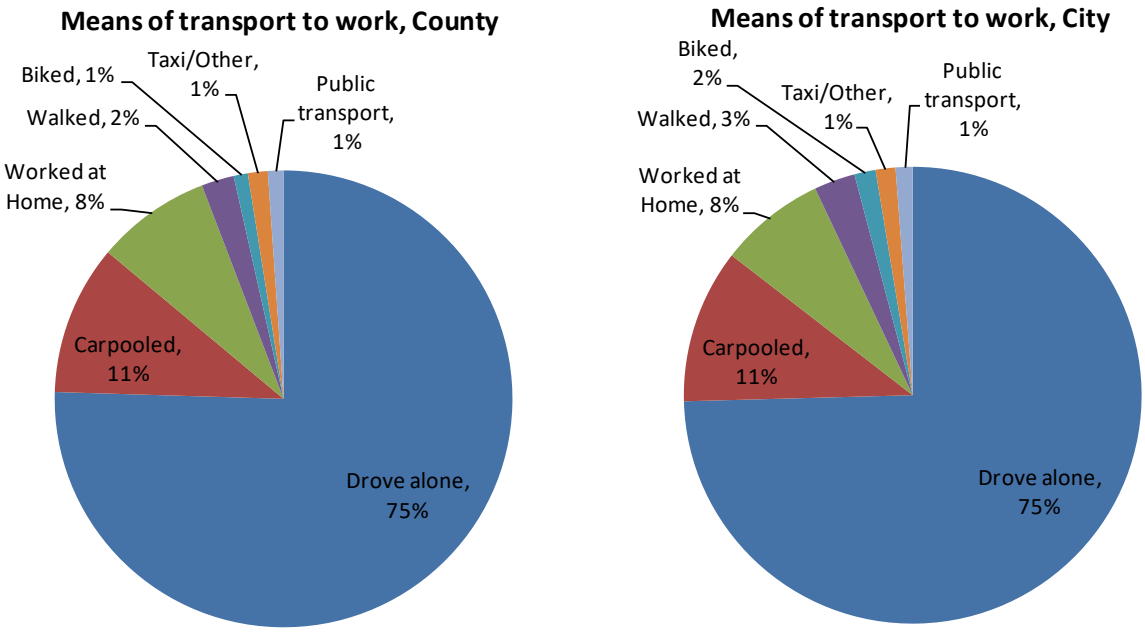

Figure 13: Primary means of commuting to work in Santa Fe County and the City of Santa Fe for 2015 (US Census Bureau 2015)

The New Mexico Department of Transportation uses portable and permanent counters to compile roadway traffic counts, which are then used to estimate daily vehicle miles traveled (DVMT) within the County. From DVMT, estimations of gasoline and diesel fuel consumption were made using nationwide assumptions about the breakdown of vehicles by class and the average fuel efficiency of each vehicle class[10]. The figure below shows the trend in DVMT from 2010 – 2015 in the County, with a 13% increase in DVMT over five years.

[10] DVMT data from State of New Mexico Department of Transportation, vehicle class breakdown from ICLEI Clearpath, and mpg data is from the EIA's Annual Energy Outlook 2015 Transportation Sector Key Indicators. Gasoline Passenger Vehicles: 60.6%, 22.6 mpg, Gasoline Light Trucks: 32.4%, 16.1 mpg, Diesel Passenger Vehicles: 0.3%, 22.6 mpg, Diesel Light Trucks: 1.3%, 16.1 mpg, and Diesel Heavy Trucks: 5.4%, 6.8 mpg.

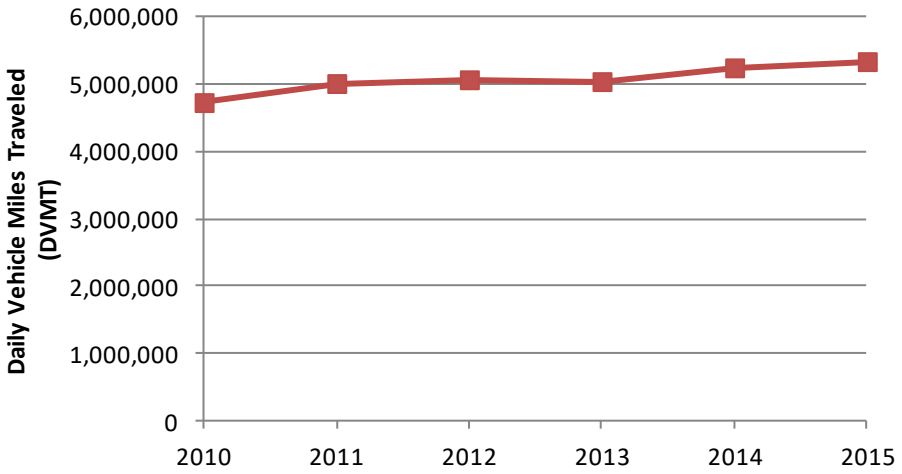

Figure 14: DVMT for Santa Fe County, 2010 – 2015. Source: NM Department of Transportation.

The table below shows DVMT, gasoline and diesel consumption estimates, and total emissions in the City, MPA, and County.

2015 Estimation	DVMT	Gasoline (gal)	Diesel (gal)	tCO2e
City of Santa Fe	3,021,684	51,769,028	9,795,396	518,510
Santa Fe MPA	4,304,424	73,745,581	13,953,656	738,624
Santa Fe County	5,342,300	91,527,007	17,318,141	916,719

Table 3: Estimated emissions for on-road transport for the City of Santa Fe, Santa Fe MPA, and Santa Fe County.

Box 4: Moving Transportation Forward

If Santa Fe is going to make serious reductions to its GHG emissions, then significant changes will need to be made in the transportation sector, and the city's urban form[11]. Transportation is a sector where decrease in transportation times and costs can have significant impacts on low income households. Globally, the transportation sector is changing quickly with disruptions from mobile technology used by companies like Uber, the unknown future of driverless cars, and greater uptake of electric vehicles. Typical levers for reducing emissions from transportation include:

1) Reducing demand by more efficiently connecting users to their needs

This means increasing the accessibility to goods and services while reducing commuting times and costs. A critical step towards achieving this is restructuring the urban form: increasing in-fill, creating more mixed-used, higher density developments along transportation corridors, and preserving green spaces. Over 20% of lots in the City of Santa Fe are currently vacant, and more can be done to incentivize work-live developments along key arteries like Cerillos and St. Francis.

2) Increasing efficiency of transportation modes

As urban density increases, so can traffic congestion if development isn't paired with access to efficient public transport and sufficient connectivity for walking and biking, reducing dependency on cars. It is imperative to assure that people have access to affordable and efficient bus systems. Santa Fe currently has a variety of public

[11] See, for example, http://newclimateeconomy.report/2015/wp-content/uploads/sites/3/2016/04/LSE-Cities-2014-Transport-and-Urban-Form-NCE-Cities-Paper-03.pdf

transportation options, including a bus system with 11 routes and an annual ridership of over 1 million passengers. However, the US Census reveals that only 1% of people in the City currently utilize public transport to get to work. In addition, there should be both sticks and carrots, encouraging people to purchase more fuel efficient vehicles. According to vehicle registrations for Santa Fe County, approximately 50% of vehicles are more than 10 years old, with annual new car purchases of about 5%.

3) Reducing carbon intensity of vehicle fuels

Most experts agree that the only way that full decarbonization can be achieved in the transportation sector is through electrification of all vehicles, utilizing renewable energy-based electricity systems. This requires a medium to long term vision, waiting for the cost of electric vehicles to drop substantially, as well as hoping for deeper carbon cuts in PNM's electricity portfolio. An electric vehicle that is currently charged on PNM's grid (using the 2015 PNM grid emission factor of 0.60 kgCO2/kWh) has the same driving emissions as a gasoline engine that gets 50 mpg (about the mpg of a Toyota Prius).

Railway

The only rail transportation that services commuters within Santa Fe County is the Rio Metro Rail Runner, which starts and stops in downtown Santa Fe, and runs south through Albuquerque to Belen[12]. The Rail Runner makes 4,762 trips per year into and out of Santa Fe County, with 338,000 passengers boarding and 336,000 passengers alighting the train in the county in 2015. Using data provided by New Mexico Rio Metro, and a calculated train efficiency of 0.49 mpg of diesel, the table shows the annual carbon emissions occurring within the jurisdiction boundaries.

	Santa Fe	Santa Fe MPA	Santa Fe County
Miles in jurisdiction per trip	5	20	25
Miles/year	23,810	95,240	119,050
Gallons Diesel	48,592	194,367	242,959
tCO2e	500	1,998	2,498
% of total carbon emissions	**0.05%**	**0.13%**	**0.14%**

Table 4: Territorial CO2 emissions for Rail Runner trips within Santa Fe County, 2015

In 2015, the Rio Metro reported 44,564,432 passenger miles, system-wide, and 1,059,933 gallons of diesel consumed. This means the Rail Runner has a per-passenger efficiency of 42 passenger miles per gallon, which is roughly double the efficiency of a typical car, or about equal to the per-passenger efficiency of a typical car that is carrying two occupants.

Aviation

The Santa Fe community is served locally by the Santa Fe Municipal Airport (SAF). SAF serves both commercial and private flights and is located within the City's jurisdiction. SAF's emissions are counted for the City, MPA, and the County, since it resides within all three boundaries.

[12] There is also a small train that runs from Santa Fe to Lamy twice per week, primarily for tourist visits in the summer. The southern boundary of the Santa Fe MPA is spanned by a rail line that is primarily serviced by the Amtrak Southern Chief, which has a train that runs from Chicago to Los Angeles.

In 2015, the Santa Fe Municipal airport recorded 2,550,413 gallons of fuel sold to both commercial and private planes. Assuming that all commercial aircraft use jet fuel and private planes primarily use aviation gas, we can estimate total emissions as 23,587 tCO2e for 2015 from aviation originating within the geographic boundaries. Overall, the emissions account for 2.1%, 1.6%, and 1.3% of the total emissions for the City, MPA, and County, respectively.

Flight type at SAF	Gallons	Fuel	Percent	tCO2e
Commercial	1,450,519	Jet Fuel	57%	14,229
Private/military	1,099,895	Av Gas	43%	9,358
Total aviation emissions for County, MPA, and City				23,587

Table 5: Estimation of 2015 CO2 emissions resulting from fuel consumption by commercial and private planes in Santa Fe County

This calculation assumes that we are only attributing emissions to half of the round-trip flight for all flights originating outside of SAF (i.e., all commercial flights). This is consistent with the fuel sales method outlined in the GPC.

Box 5: Aviation Emissions from Albuquerque Sunport

It is important to note the emissions for the SAF airport underestimate aviation emissions induced by people traveling to or from Santa Fe, since the majority of domestic flights need to be taken from Albuquerque International Airport (ABQ). However, since the emissions from these flights would be outside of Santa Fe County's geographic boundary (Scope 3 emissions) they were not included in the inventory, but have been estimated here to give a sense of their magnitude. A planning report for the Albuquerque airport estimates that there were 33,000,000 gallons of jet fuel consumed in 2013 at the airport, and that "studies have shown that over two-thirds of the originating passengers come from within a thirty-mile radius of the Sunport. The next largest contributor has been the Santa Fe/Los Alamos area."[13] Assuming that 10 percent of originating passengers come from Santa Fe, the fraction of emissions induced by Santa Fe travelers is estimated in the table below, and is about 35% larger than those estimated for SAF, but still quite small in terms of the overall emissions in the inventory.

	Jet A Fuel (gal)	ktCO2	% attributed to Santa Fe	tCO2e
2013 ABQ airport	33,000,000	316	10%	31,583,674

Table 6: Estimation of Scope 3 emissions attributed to commercial passengers originating in Santa Fe

5. Waste

Waste emissions in this inventory are caused by the anaerobic decay of biomass in landfill waste and wastewater, which leads to the production of methane gas (CH4). Methane is a potent greenhouse gas, which has a warming

[13] http://thesunport.airportstudy.com/master-plan/

potential equivalent to 25 times[14] that of carbon dioxide. Emissions from landfill solid waste and waste water each accounts for about 1% of the total inventory emissions, in the City, MPA, and County.

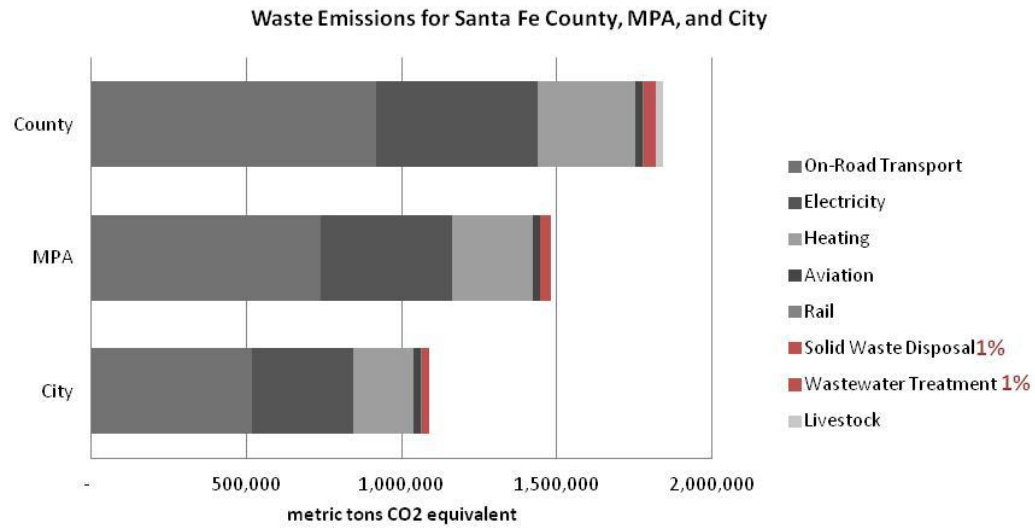

Figure 15: Waste emissions, as a percent of total emissions for Santa Fe County, MPA, and City, 2015

Solid waste disposal

The Environmental Services Division of the City of Santa Fe provides residential and commercial trash and recycling collection to 29,300 single family homes and about 2,500 businesses. The City and the County work together with the Santa Fe Solid Waste Management Agency (SFSWMA) to operate the Caja del Rio Landfill. The Caja del Rio landfill serves all of Santa Fe County, with the exception of Edgewood (population 3,777). The landfill recorded 138,598 metric tons of waste in 2015, equivalent to 956 kg of waste per person.

The carbon dioxide equivalent emission estimates for the landfill, in the table below, are taken from the EPA's GHG reporting site[15] , which has an annual report submitted by a consultant for the landfill. The emissions are estimated based upon a first order decay model that accounts for the total recorded annual tonnage, an estimate of the different products composing the waste stream, and the total time that the waste has been in the landfill.

Emissions estimates submitted to EPA	2010	2011	2012	2013	2014	2015
Caja del Rio Annual Waste (metric tons)	137,547	137,080	135,141	136,553	142,711	138,598
Caja del Rio Historical Emissions (tCO2e)	7,958	21,358	23,502	24,844	24,359	22,250

Table 7: GHG emissions estimates from anaerobic landfill decay at Caja del Rio Landfill, submitted to the US EPA (including minor contributions to CO2 emissions from onsite generators)

Using a county population of 144,623 (2015 population, minus Edgewood's population), gives a per capita emissions from landfill use of 0.1532 tCO2 equivalent. Using this as a scaling factor, estimations for total emissions for Santa Fe and the MPA are shown in the table below.

[14] Using 100-year Global Warming Potential (GWP) from the IPCC 4th Assessment Report (AR4), consistent with the values used for the 2015 US National GHG Inventory.
[15] http://ghgdata.epa.gov/ghgp/service/facilityDetail/2014?id=1006724&ds=E&et=&popup=true

Jurisdiction	Population	tCH4/yr	tCO2e/yr	% of total emissions
Santa Fe City	84,099	515	12,882	1.2%
Santa Fe MPA	119,800	734	18,351	1.2%
Santa Fe County	148,686	911	22,756	1.2%

Table 8: Estimated GHG emissions from landfills for the City of Santa Fe, MPA, and County for 2015.

Wastewater treatment

Santa Fe's Wastewater Management Division treats sewage water from the population of the City of Santa Fe, as well as some nearby locations in the county, serving an estimated population of 82,000 people.

The Wastewater Management Division provided annual tables of data, from which the average values in the table below were taken. The table shows the annual volume of influent, the oxygen demand level (which is a proxy for the quantity of organic matter in the water), and the amount of methane gas that is flared from their anaerobic digesters (which indicates the rate and quantity of organic material that is being treated).

Description	Units	2012	2013	2014[16]	2015
wastewater influent flow rate	m^3/hr	906	892	883	854
oxygen demand BOD5	mg/l	432	421	506	627
Methane flared at plant	tCH_4/yr	275	529	907	1021

Table 9: Influent flow rate, 5-day biochemical oxygen demand (BOD5), and methane production from anaerobic digesters at the Santa Fe Wastewater plant

Using the data above and a series of formulas recommended in the GPC, an estimation of the CO2 equivalent emissions produced from the Santa Fe Wastewater Facility was calculated on a per capita basis. The per capita emissions were then used to estimate total emissions for the City, County, and MPA, shown in the table below.

	Population	tCH4/yr	tCO2e/yr	% of total emissions
Santa Fe	84,099	437	10,928	1%
Santa Fe MPA	119,800	623	15,567	1%
Santa Fe County	148,686	773	19,321	1%

Table 10: Emissions estimates for Santa Fe, Santa Fe County, and Santa Fe MPA, based on the per capita emissions for Santa Fe wastewater facility, using a methane global warming potential of 25.

6. Agriculture, forestry, and other land use

Agriculture

Globally, the largest causes of GHG emissions from agriculture, forestry, and other land use are deforestation, cattle, and soil and land management practices.

In 2012 there were 715 farms in Santa Fe County, covering a total acreage of 1,121 square miles, 60% of the total land area in Santa Fe County. However, 92% of these farm holdings were pasture land (USDA 2012).

Methane emission from farm animals, due to digestion (enteric fermentation) and manure management can have significant contributions to a community's GHG inventory. The following table estimates the methane emissions

[16] There were extremely high BOD5 values during some periods of 2014 (as high as 39960). The director reported that "the sampling line had come loose and was floating on top of the channel." The largest of the numbers were filtered out, though the BOD5 numbers for 2014 should be treated with caution.

resulting from livestock digestion and manure management in Santa Fe County, using agricultural inventory numbers from 2012.

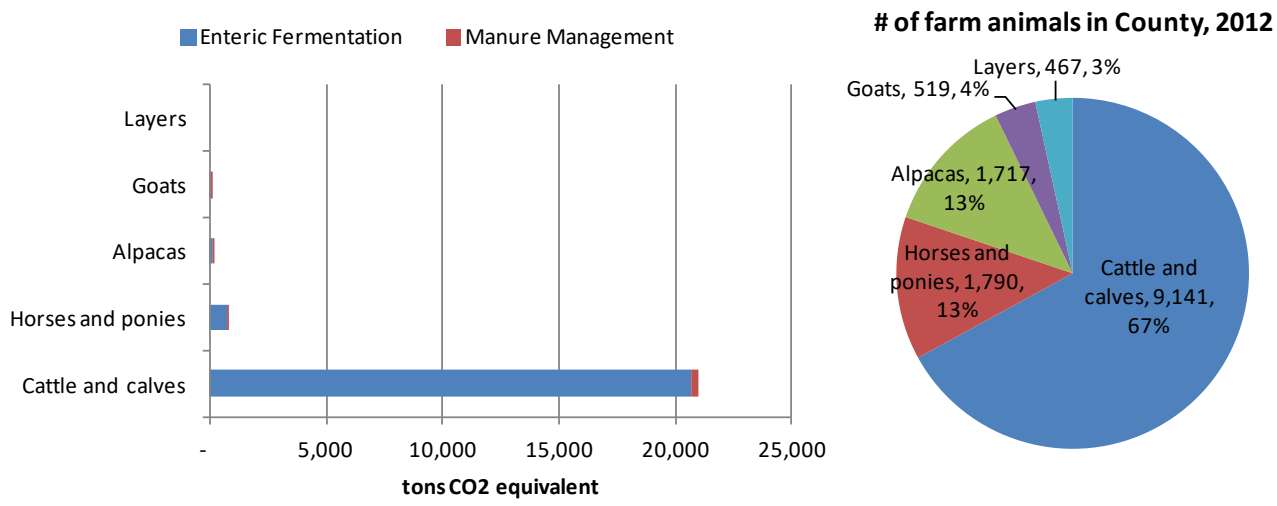

Figure 16: Methane emissions from enteric fermentation and manure management of animals in Santa Fe County. Animal inventory from (USDA 2012)[17]. Emission factors are from IPCC 2006, Vol 4, Ch 10[18].

It is assumed that most of the animals are grazed on pasture and so the manure is not collected and stored, leading to negligible emissions of nitrous oxide. The estimation reveals that 98% of the livestock emissions come from livestock digestion, of which, 96% is from cows. Livestock emissions account for 1% of the overall inventory emissions in Santa Fe County. No estimate was made of the percent of livestock residing in Santa Fe or the MPA.

Forestry and other Land Use

Estimating emissions from forestry and land use changes are complicated, but can be a significant source of emissions where land is changing from one type of ecosystem to another, either through decomposition, forest fires, or deforestation and logging. Ecosystems can also act as carbon sinks due to changing patterns of use, or the age of the systems. Carbon is accumulated and stored in above ground biomass, below ground biomass, and soil. Biomass carbon stocks can act as sinks through growth (photosynthesis), as well as through the harvesting of timber for building materials. Various forest management activities can impact the carbon sequestration potential of forest lands, ranging from 0.2 tCO2/acre/year when adopting low-impact logging to up to 3 tCO2/acre/year for reforestation[19]. On a global scale, soil organic carbon (SOC) far exceeds that stored in either the atmosphere or land based vegetation. Ecosystem changes, farming, and animal management can have large impacts on SOC.

Due to the large range of uncertainty in estimating carbon fluxes in forests and natural lands, this section does not seek to provide an estimate of emissions or carbon sequestration rates from land use in Santa Fe County. However, it does provide estimations of carbon stocks in various ecosystems in Santa Fe County, which could be used for estimating emissions/sequestration from future large-scale natural or human-induced land use changes, with respect to this 2015 baseline.

[17] https://www.agcensus.usda.gov/Publications/2012/Online_Resources/County_Profiles/New_Mexico/cp35049.pdf
[18] http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_10_Ch10_Livestock.pdf
[19] http://www.epa.gov/sequestration/rates.html.

The figure below shows the various land classes that can be found in Santa Fe County. The inset image, on the upper right of the figure, shows where the Santa Fe National Forest, in green, overlaps with part of the County.

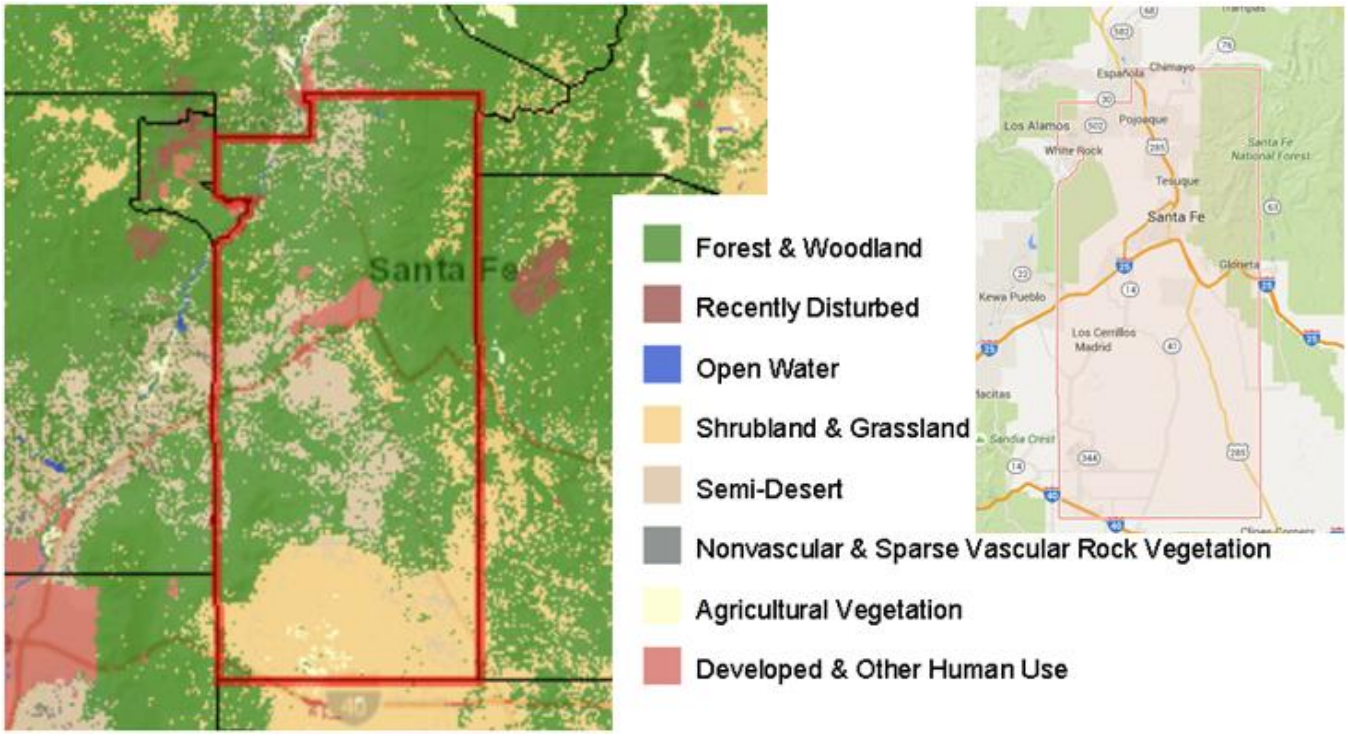

Figure 17: Land Classes within Santa Fe County. The small map on the right shows overlap of Santa Fe County with the Santa Fe National Forest[20].

Using carbon inventory from the Santa Fe National Forest and USGS land use composition for Santa Fe County, an estimation of carbon stocks can be estimated, shown in the table below.

Land Use Composition in Santa Fe County	Acres	% of Total	Estimated tC/acre	Total tC
Forest & Woodland	701,752	57.41%	28	19,649,068
Shrubland & Grassland	291,913	23.88%	4	1,167,654
Semi-Desert	188,257	15.40%	3	564,771
Nonvascular & Sparse Vascular Rock Veg	6,258	0.51%	0	0
Agricultural Vegetation	7,800	0.64%		
Developed & Other Human Use	25,746	2.11%		
Open Water	675	0.06%		

Table 11: Estimation of carbon stocks in Santa Fe County. The acreage of various ecosystems was taken from USGS Land Cover Report Santa Fe County, USGS Gap Analysis Program, accessed April 2016. The estimated amount of carbon per acre in the various ecosystems are averages derived from the detailed land cover report, using carbon rates taken from a study of Santa Fe National Forest (USDA 2016), in which the authors noted that they didn't account for soil carbon for grasslands and shrublands (p276).

[20] Source: http://gis1.usgs.gov/csas/gap/viewer/land_cover/Map.aspx

It is important to note that the total annual carbon emisisons (not CO2) in the present inventory is only 2% of the estimated carbon stored in forests and woodlands within Santa Fe County, highlighting the importance of preserving these critical ecosystems.

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Appendix 1: GHG Inventory Sheet for the City of Santa Fe

Scope	GHG Emissions Source (By Sector and Sub-sector)	Status	If you can provide no value, please explain why (Notation keys)	Gases (in tonnes = metric ton = symbol t)							
				CO_2	CH_4	N_2O	HFC	PFC	SF_6	NF_3	Total CO_2e
	STATIONARY ENERGY										
	Residential buildings										
1	Emissions from fuel combustion within the city boundary	x		118,581.03	11.18	0.22					118,904.88
2	Emissions from grid-supplied energy consumed within the city boundary	x		130,906.85	15.07	2.18					131,715.54
3	Transmission and distribution losses from grid-supplied energy	x		4948.28	0.57	0.08					4,978.85
	Commercial and institutional buildings and facilities										
1	Emissions from fuel combustion within the city boundary	x		77,984.43	7.35	0.15					78,197.41
2	Emissions from grid-supplied energy consumed within the city boundary	x		179,949.02	20.71	3.00					181,060.67
3	Transmission and distribution losses from grid-supplied energy	x		6802.07	0.78	0.11					6,844.09
	Manufacturing industries and construction										
1	Emissions from fuel combustion within the city boundary	x	NO - Not Occuring								
2	Emissions from grid-supplied energy consumed within the city boundary	x	NO - Not Occuring								
3	Transmission and distribution losses from grid-supplied energy	x	NO - Not Occuring								
	Energy industries										
1	Emissions from energy production used in power plant auxiliary operations within the city	x	NO - Not Occuring								
2	Emissions from grid-supplied energy consumed by energy industries	x	IE - Included Elsewhere								
3	Emissions from transmission and distribution losses from grid-supplied energy used in	x	IE - Included Elsewhere								
1	Emissions from energy generation supplied to the grid	x	NE - Not Estimated								
	Agriculture, forestry and fishing activities										
1	Emissions from fuel combustion within the city boundary	x	NO - Not Occuring								
2	Emissions from grid-supplied energy consumed within the city boundary	x	IE - Included Elsewhere								
3	Transmission and distribution losses from grid-supplied energy consumption	x	IE - Included Elsewhere								
	Non-specified sources										
1	Emissions from fuel combustion within the city boundary	x	NO - Not Occuring								
2	Emissions from grid-supplied energy consumed within the city boundary	x	IE - Included Elsewhere								
3	Emissions from transmission and distribution losses from grid-supplied energy	x	IE - Included Elsewhere								
	Fugitive emissions from mining, processing, storage, and transportation of coal										
1	Emissions from fugitive emissions within the city boundary	x	NO - Not Occuring								
	Fugitive emissions from oil and natural gas systems										
1	Emissions from fugitive emissions within the city boundary	x	NO - Not Occuring								
Scope	GHG Emissions Source (By Sector and Sub-sector)		Notation keys	CO_2	CH_4	N_2O	HFC	PFC	SF_6	NF_3	**Total CO_2e**
	TRANSPORTATION										
	On-road transportation										
1	Emissions from fuel combustion on-road transportation occurring in the city	x		509089.86	25.77	44.32					518,510.10
2	Emissions from grid-supplied energy consumed in the city for on-road transportation	x	IE - Included Elsewhere								
3	Emissions from portion of transboundary journeys occurring outside the city, and	x	NE - Not Estimated								
	Railways										
1	Emissions from fuel combustion for railway transportation occurring in the city	x		496.12	0.04	0.01					499.60
2	Emissions from grid-supplied energy consumed in the city for railways	x	NO - Not Occuring								
3	Emissions from portion of transboundary journeys occurring outside the city, and	x	NE - Not Estimated								
	Waterborne navigation										
1	Emissions from fuel combustion for waterborne navigation occurring in the city	x	NO - Not Occuring								
2	Emissions from grid-supplied energy consumed in the city for waterborne navigation	x	NO - Not Occuring								
3	Emissions from portion of transboundary journeys occurring outside the city, and	x	NO - Not Occuring								
	Aviation										
1	Emissions from fuel combustion for aviation occurring in the city	x		9140.12	7.77	0.12					9,358.21
2	Emissions from grid-supplied energy consumed in the city for aviation	x	IE - Included Elsewhere								
3	Emissions from portion of transboundary journeys occurring outside the city, and	x		14142.56	0.00	0.44					14,228.72
	Off-road transportation										
1	Emissions from fuel combustion for off-road transportation occurring in the city	x	NE - Not Estimated								
2	Emissions from grid-supplied energy consumed in the city for off-road transportation	x	NE - Not Estimated								
3	Emissions from portion of transboundary journeys occurring outside the city, and	x	NE - Not Estimated								
Scope	GHG Emissions Source (By Sector and Sub-sector)		Notation keys	CO_2	CH_4	N_2O	HFC	PFC	SF_6	NF_3	**Total CO_2e**
	WASTE										
	Solid waste disposal										
1	Emissions from solid waste generated in the city and disposed in landfills or open dumps	x		0.00	515.29	0.00					12,882.19
3	Emissions from solid waste generated in the city but disposed in landfills or open dumps	x	NE - Not Estimated								
1	Emissions from waste generated outside the city and disposed in landfills or open dumps	x	NE - Not Estimated								
	Biological treatment of waste										
1	Emissions from solid waste generated in the city that is treated biologically in the city	x	NO - Not Occuring								
3	Emissions from solid waste generated in the city but treated biologically outside of the	x	NO - Not Occuring								
1	Emissions from waste generated outside the city boundary but treated in the city	x	NO - Not Occuring								
	Incineration and open burning										
1	Emissions from waste generated and treated within the city	x	NO - Not Occuring								
3	Emissions from waste generated within but treated outside of the city	x	NE - Not Estimated								
1	Emissions from waste generated outside the city boundary but treated within the city	x	NE - Not Estimated								
	Wastewater treatment and discharge										
1	Emissions from wastewater generated and treated within the city	x			437.13						10,928.30
3	Emissions from wastewater generated within but treated outside of the city	x	NE - Not Estimated								
1	Emissions from wastewater generated outside the city boundary but treated within the city	x	NE - Not Estimated								
Scope	GHG Emissions Source (By Sector and Sub-sector)		Notation keys	CO_2	CH_4	N_2O	HFC	PFC	SF_6	NF_3	**Total CO_2e**
	INDUSTRIAL PROCESSES and PRODUCT USES (IPPU)										
1	Emissions from industrial processes occurring in the city boundary	x	NE - Not Estimated								
1	Emissions from product use occurring within the city boundary	x	NE - Not Estimated								
	AGRICULTURE, FORESTRY and OTHER LAND USE (AFOLU)										
1	Emissions from livestock	x	NO - Not Occuring								
1	Emissions from land	x	NE - Not Estimated								
1	Emissions from aggregate sources and non-CO2 emission sources on land	x	NE - Not Estimated								
	OTHER SCOPE 3										
3	Other Scope 3	x	NE - Not Estimated								

Appendix 2: GHG Inventory Sheet for Santa Fe Metropolitan Planning Area (MPA)

Scope	GHG Emissions Source (By Sector and Sub-sector)	Status	If you can provide no value, please explain why (Notation keys)	Gases (in tonnes = metric ton = symbol t)							
				CO_2	CH_4	N_2O	HFC	PFC	SF_6	NF_3	Total CO_2e
	STATIONARY ENERGY										
	Residential buildings										
1	Emissions from fuel combustion within the city boundary	x		163,026.24	15.37	0.31					163,471.47
2	Emissions from grid-supplied energy consumed within the city boundary	x		183,852.99	21.16	3.75					185,124.58
3	Transmission and distribution losses from grid-supplied energy	x		6949.64	0.80	0.14					6,997.71
	Commercial and institutional buildings and facilities										
1	Emissions from fuel combustion within the city boundary	x		96,030.17	9.06	0.18					96,292.43
2	Emissions from grid-supplied energy consumed within the city boundary	x		221,589.55	25.51	3.69					222,958.43
3	Transmission and distribution losses from grid-supplied energy	x		8376.09	0.96	0.14					8,427.83
	Manufacturing industries and construction										
1	Emissions from fuel combustion within the city boundary	x	NO - Not Occuring								
2	Emissions from grid-supplied energy consumed within the city boundary	x	NO - Not Occuring								
3	Transmission and distribution losses from grid-supplied energy	x	NO - Not Occuring								
	Energy industries										
1	Emissions from energy production used in power plant auxiliary operations within the city	x	NE - Not Estimated								
2	Emissions from grid-supplied energy consumed by energy industries	x	IE - Included Elsewhere								
3	Emissions from transmission and distribution losses from grid-supplied energy used in	x	IE - Included Elsewhere								
1	Emissions from energy generation supplied to the grid	x	NE - Not Estimated								
	Agriculture, forestry and fishing activities										
1	Emissions from fuel combustion within the city boundary	x	NE - Not Estimated								
2	Emissions from grid-supplied energy consumed within the city boundary	x	IE - Included Elsewhere								
3	Transmission and distribution losses from grid-supplied energy consumption	x	IE - Included Elsewhere								
	Non-specified sources										
1	Emissions from fuel combustion within the city boundary	x	NE - Not Estimated								
2	Emissions from grid-supplied energy consumed within the city boundary	x	IE - Included Elsewhere								
3	Emissions from transmission and distribution losses from grid-supplied energy	x	IE - Included Elsewhere								
	Fugitive emissions from mining, processing, storage, and transportation of coal										
1	Emissions from fugitive emissions within the city boundary	x	NE - Not Estimated								
	Fugitive emissions from oil and natural gas systems										
1	Emissions from fugitive emissions within the city boundary	x	NE - Not Estimated								
Scope	GHG Emissions Source (By Sector and Sub-sector)		Notation keys	CO_2	CH_4	N_2O	HFC	PFC	SF_6	NF_3	**Total CO_2e**
	TRANSPORTATION										
	On-road transportation										
1	Emissions from fuel combustion on-road transportation occurring in the city	x		725204.40	36.71	63.14					738,623.65
2	Emissions from grid-supplied energy consumed in the city for on-road transportation	x	IE - Included Elsewhere								
3	Emissions from portion of transboundary journeys occurring outside the city, and	x	NE - Not Estimated								
	Railways										
1	Emissions from fuel combustion for railway transportation occurring in the city	x		1984.49	0.16	0.05					1,998.38
2	Emissions from grid-supplied energy consumed in the city for railways	x	NO - Not Occuring								
3	Emissions from portion of transboundary journeys occurring outside the city, and	x	NE - Not Estimated								
	Waterborne navigation										
1	Emissions from fuel combustion for waterborne navigation occurring in the city	x	NO - Not Occuring								
2	Emissions from grid-supplied energy consumed in the city for waterborne navigation	x	NO - Not Occuring								
3	Emissions from portion of transboundary journeys occurring outside the city, and	x	NO - Not Occuring								
	Aviation										
1	Emissions from fuel combustion for aviation occurring in the city	x		9140.12	7.77	0.12					9,358.21
2	Emissions from grid-supplied energy consumed in the city for aviation	x	IE - Included Elsewhere								
3	Emissions from portion of transboundary journeys occurring outside the city, and	x		14142.56	0.00	0.44					14,228.72
	Off-road transportation										
1	Emissions from fuel combustion for off-road transportation occurring in the city	x	NE - Not Estimated								
2	Emissions from grid-supplied energy consumed in the city for off-road transportation	x	NE - Not Estimated								
3	Emissions from portion of transboundary journeys occurring outside the city, and	x	NE - Not Estimated								
Scope	GHG Emissions Source (By Sector and Sub-sector)		Notation keys	CO_2	CH_4	N_2O	HFC	PFC	SF_6	NF_3	**Total CO_2e**
	WASTE										
	Solid waste disposal										
1	Emissions from solid waste generated in the city and disposed in landfills or open dumps	x		0.00	734.03	0.00					18,350.83
3	Emissions from solid waste generated in the city but disposed in landfills or open dumps	x	NE - Not Estimated								
1	Emissions from waste generated outside the city and disposed in landfills or open dumps	x	NE - Not Estimated								
	Biological treatment of waste										
1	Emissions from solid waste generated in the city that is treated biologically in the city	x	NO - Not Occuring								
3	Emissions from solid waste generated in the city but treated biologically outside of the	x	NO - Not Occuring								
1	Emissions from waste generated outside the city boundary but treated in the city	x	NO - Not Occuring								
	Incineration and open burning										
1	Emissions from waste generated and treated within the city	x	NO - Not Occuring								
3	Emissions from waste generated within but treated outside of the city	x	NE - Not Estimated								
1	Emissions from waste generated outside the city boundary but treated within the city	x	NE - Not Estimated								
	Wastewater treatment and discharge										
1	Emissions from wastewater generated and treated within the city	x			622.70						15,567.49
3	Emissions from wastewater generated within but treated outside of the city	x	NE - Not Estimated								
1	Emissions from wastewater generated outside the city boundary but treated within the city	x	NE - Not Estimated								
Scope	GHG Emissions Source (By Sector and Sub-sector)		Notation keys	CO_2	CH_4	N_2O	HFC	PFC	SF_6	NF_3	**Total CO_2e**
	INDUSTRIAL PROCESSES and PRODUCT USES (IPPU)										
1	Emissions from industrial processes occurring in the city boundary	x	NE - Not Estimated								
1	Emissions from product use occurring within the city boundary	x	NE - Not Estimated								
	AGRICULTURE, FORESTRY and OTHER LAND USE (AFOLU)										
1	Emissions from livestock	x	NE - Not Estimated								
1	Emissions from land	x	NE - Not Estimated								
1	Emissions from aggregate sources and non-CO2 emission sources on land	x	NE - Not Estimated								
	OTHER SCOPE 3										
3	Other Scope 3	x	NE - Not Estimated								

Appendix 3: GHG Inventory Sheet for Santa Fe County

Scope	GHG Emissions Source (By Sector and Sub-sector)	Status	If you can provide no value, please explain why (Notation keys)	Gases (in tonnes = metric ton = symbol t)							
				CO_2	CH_4	N_2O	HFC	PFC	SF_6	NF_3	Total CO_2e
	STATIONARY ENERGY										
	Residential buildings										
1	Emissions from fuel combustion within the city boundary	x		195,223.08	18.41	0.37					195,756.25
2	Emissions from grid-supplied energy consumed within the city boundary	x		225,015.46	25.90	3.75					226,405.51
3	Transmission and distribution losses from grid-supplied energy	x		8505.58	0.98	0.14					8,558.13
	Commercial and institutional buildings and facilities										
1	Emissions from fuel combustion within the city boundary	x		119,184.82	11.24	0.22					119,510.32
2	Emissions from grid-supplied energy consumed within the city boundary	x		275,018.90	31.66	4.58					276,717.84
3	Transmission and distribution losses from grid-supplied energy	x		10395.71	1.20	0.17					10,459.93
	Manufacturing industries and construction										
1	Emissions from fuel combustion within the city boundary	x	NO - Not Occuring								
2	Emissions from grid-supplied energy consumed within the city boundary	x	NO - Not Occuring								
3	Transmission and distribution losses from grid-supplied energy	x	NO - Not Occuring								
	Energy industries										
1	Emissions from energy production used in power plant auxiliary operations within the city	x	NE - Not Estimated								
2	Emissions from grid-supplied energy consumed by energy industries	x	IE - Included Elsewhere								
3	Emissions from transmission and distribution losses from grid-supplied energy used in	x	IE - Included Elsewhere								
1	Emissions from energy generation supplied to the grid	x	NE - Not Estimated								
	Agriculture, forestry and fishing activities										
1	Emissions from fuel combustion within the city boundary	x	NE - Not Estimated								
2	Emissions from grid-supplied energy consumed within the city boundary	x	IE - Included Elsewhere								
3	Transmission and distribution losses from grid-supplied energy consumption	x	IE - Included Elsewhere								
	Non-specified sources										
1	Emissions from fuel combustion within the city boundary	x	NE - Not Estimated								
2	Emissions from grid-supplied energy consumed within the city boundary	x	IE - Included Elsewhere								
3	Emissions from transmission and distribution losses from grid-supplied energy	x	IE - Included Elsewhere								
	Fugitive emissions from mining, processing, storage, and transportation of coal										
1	Emissions from fugitive emissions within the city boundary	x	NE - Not Estimated								
	Fugitive emissions from oil and natural gas systems										
1	Emissions from fugitive emissions within the city boundary	x	NE - Not Estimated								
Scope	GHG Emissions Source (By Sector and Sub-sector)		Notation keys	CO_2	CH_4	N_2O	HFC	PFC	SF_6	NF_3	**Total CO_2e**
	TRANSPORTATION										
	On-road transportation										
1	Emissions from fuel combustion on-road transportation occurring in the city	x		900064.62	45.57	78.36					916,719.50
2	Emissions from grid-supplied energy consumed in the city for on-road transportation	x	IE - Included Elsewhere								
3	Emissions from portion of transboundary journeys occurring outside the city, and	x	NE - Not Estimated								
	Railways										
1	Emissions from fuel combustion for railway transportation occurring in the city	x		2480.61	0.19	0.06					2,497.98
2	Emissions from grid-supplied energy consumed in the city for railways	x	NO - Not Occuring								
3	Emissions from portion of transboundary journeys occurring outside the city, and	x	NE - Not Estimated								
	Waterborne navigation										
1	Emissions from fuel combustion for waterborne navigation occurring in the city	x	NO - Not Occuring								
2	Emissions from grid-supplied energy consumed in the city for waterborne navigation	x	NO - Not Occuring								
3	Emissions from portion of transboundary journeys occurring outside the city, and	x	NO - Not Occuring								
	Aviation										
1	Emissions from fuel combustion for aviation occurring in the city	x		9140.12	7.77	0.12					9,358.21
2	Emissions from grid-supplied energy consumed in the city for aviation	x	IE - Included Elsewhere								
3	Emissions from portion of transboundary journeys occurring outside the city, and	x		14142.56	0.00	0.44					14,228.72
	Off-road transportation										
1	Emissions from fuel combustion for off-road transportation occurring in the city	x	NE - Not Estimated								
2	Emissions from grid-supplied energy consumed in the city for off-road transportation	x	NE - Not Estimated								
3	Emissions from portion of transboundary journeys occurring outside the city, and	x	NE - Not Estimated								
Scope	GHG Emissions Source (By Sector and Sub-sector)		Notation keys	CO_2	CH_4	N_2O	HFC	PFC	SF_6	NF_3	**Total CO_2e**
	WASTE										
	Solid waste disposal										
1	Emissions from solid waste generated in the city and disposed in landfills or open dumps	x		0.00	911.02	0.00					22,775.56
3	Emissions from solid waste generated in the city but disposed in landfills or open dumps	x	NE - Not Estimated								
1	Emissions from waste generated outside the city and disposed in landfills or open dumps	x	NE - Not Estimated								
	Biological treatment of waste										
1	Emissions from solid waste generated in the city that is treated biologically in the city	x	NO - Not Occuring								
3	Emissions from solid waste generated in the city but treated biologically outside of the	x	NO - Not Occuring								
1	Emissions from waste generated outside the city boundary but treated in the city	x	NO - Not Occuring								
	Incineration and open burning										
1	Emissions from waste generated and treated within the city	x	NO - Not Occuring								
3	Emissions from waste generated within but treated outside of the city	x	NE - Not Estimated								
1	Emissions from waste generated outside the city boundary but treated within the city	x	NE - Not Estimated								
	Wastewater treatment and discharge										
1	Emissions from wastewater generated and treated within the city	x			772.84						19,321.10
3	Emissions from wastewater generated within but treated outside of the city	x	NE - Not Estimated								
1	Emissions from wastewater generated outside the city boundary but treated within the city	x	NE - Not Estimated								
Scope	GHG Emissions Source (By Sector and Sub-sector)		Notation keys	CO_2	CH_4	N_2O	HFC	PFC	SF_6	NF_3	**Total CO_2e**
	INDUSTRIAL PROCESSES and PRODUCT USES (IPPU)										
1	Emissions from industrial processes occurring in the city boundary	x	NE - Not Estimated								
1	Emissions from product use occurring within the city boundary	x	NE - Not Estimated								
	AGRICULTURE, FORESTRY and OTHER LAND USE (AFOLU)										
1	Emissions from livestock	x			881.26						22,031.41
1	Emissions from land	x	NE - Not Estimated								
1	Emissions from aggregate sources and non-CO2 emission sources on land	x	NE - Not Estimated								
	OTHER SCOPE 3										
3	Other Scope 3	x	NE - Not Estimated								