4.2 Climate Change

Climate change refers to any measurable alteration of climate lasting for an extended period of time – several decades or longer –and includes recordable changes in temperature, precipitation, or wind patterns. Additionally, United Nations Framework Convention on Climate Change (United Nations 1992) defines 'Climate change' as “A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods." The Earth’s average temperature increased about 0.7 to 1.5°F (0.4 to 0.8°C) during the 1900s, and is projected to rise another 2 to 11.5°F (1.1 to 6.4°C) over the next 100 years (Intergovernmental Panel on Climate Control [IPCC] 2001, EPA 2012i). Seemingly, small changes in the average temperature of the planet can translate to large and potentially hazardous shifts in climate and weather. Climate change is suspected as the cause of changes in rainfall amounts and distribution that can result in flooding, droughts, or more frequent and severe heat waves. Also, oceans are warming and becoming more acidic, polar ice caps are melting, glaciers are receding, and sea levels are rising due to thermal expansion and ice loss. Long-term studies indicate that ocean surface temperatures have been rising at an average rate of 0.13°F (0.07°C) per decade and, since 1901, average sea level has increased by about 8 inches (20 cm). Average pH has decreased (acidified) by about 0.05 pH units since the mid-1980s. Late summer Arctic Ocean sea ice coverage has decreased by half since 1979, and glaciers have receded and lost significant mass since the 1970s (EPA 2012i). As climate change progresses in the coming decades, it will likely present challenges to society and the environment.

Over the past century, human activities have released large amounts of CO_2 and other GHGs into the atmosphere. The majority of GHGs are the by-product of burning fossil fuels to release energy in the form of heat, although deforestation, industrial processes, and some agricultural practices also emit GHGs into the atmosphere. GHGs trap solar energy in the atmosphere and cause it to warm. This phenomenon is called the greenhouse effect and is necessary to support life on Earth; however, excessive buildup of GHGs can change Earth's climate and result in undesirable effects on ecosystems, which affects human health and welfare (EPA 2012i).

In its *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2011* (EPA 2012b), the EPA provides summary information on GHG emissions by sources and removals by sinks in accordance with commitments under the United Nations Framework Convention on Climate Change (2009) and the United Nations IPCC (IPCC 1990-2007); key information from that report is summarized below.

The United Nations Framework Convention on Climate Change (2009) defines climate change as “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.” In its *Second Assessment Report* of the science of climate change, the IPCC concluded, “human activities are changing the atmospheric concentrations and distributions of greenhouse gases and aerosols” (IPCC 1995). These changes can produce a radiative forcing by changing either the reflection or absorption of solar radiation, or the emission and absorption of terrestrial radiation. Building on this conclusion, the IPCC *Third Assessment Report* asserted, “concentrations of atmospheric greenhouse gases and their radiative forcing have continued to increase as a result of human activities” (IPCC 2001).

The IPCC reports the Earth’s global average surface temperature has increased by 1.1 ± 0.4°F (0.6 ± 0.2°C) over the 20^{th} century. This value is about 0.27°F (0.15°C) larger than that estimated by the *Second Assessment Report,* which reported for the period up to 1994, “owing to the relatively high temperatures of the additional years (1995 to 2000) and improved methods of processing the data” (IPCC 2001). While the *Second Assessment Report* concluded “the balance of evidence suggests there is a discernible human influence on global climate” (IPCC 1995), the *Third Assessment Report* more directly connects the influence of human activities on climate. IPCC concluded, “In light of new evidence and taking into account the remaining uncertainties, most of the observed warming over the last 50 years is likely to have been due to the increase in greenhouse gas concentrations" (IPCC 2001).

In the *Fourth Assessment Report*, IPCC stated warming of Earth's climate is unequivocal, and that warming is very likely attributable to increases in atmospheric GHGs caused by human activities (IPCC 2007). IPCC further stated changes in many physical and biological systems, such as increases in global temperatures, more frequent heat waves, rising sea levels, coastal flooding, loss of wildlife habitat, spread of infectious disease, and other potential environmental impacts, are linked to changes in the climate system, and some changes might be irreversible (IPCC 2007).

In the most-recent *Fifth Assessment Report*, IPCC reinforced evidence for the warming of the climate system since the 1950s based on observed changes over decades to millennia (IPCC 2013). The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of GHGs have increased. Each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850. In the Northern Hemisphere, 1983 to 2012 was likely the warmest 30-year period of the last 1,400 years (IPCC 2013).

The IPCC *Fifth Assessment Report* (IPCC 2013) further concludes that:

- The atmospheric concentrations of CO_2, methane (CH_4), and nitrous oxide (N_2O) have all increased since 1750 due to human activity. In 2011, average concentrations of CO_2, CH_4, and N_2O were 390 ppm, 1.8 ppm, and 0.3 ppm, respectively, which are higher than pre-industrial levels by about 40 percent, 150 percent, and 20 percent, respectively.
- The globally-averaged combined land and ocean surface temperature data, as calculated by a linear trend, showed an average warming of 0.85°C (1.5°F) over the period 1880 to 2012. The average total increase between the 1850 to 1900 period and the 2003 to 2012 period was 0.78°C (1.4°F).
- Ocean warming dominates the increase in energy stored in the climate system, accounting for more than 90 percent of the energy accumulated between 1971 and 2010. The rate of sea level rise since the mid-19th century has been larger than the mean rate during the previous two millennia. Over the period 1901 to 2010, global mean sea level rose by 0.19 meter (0.62 feet).
- Over the last two decades, the Greenland and Antarctic ice sheets have been losing mass, glaciers have continued to shrink almost worldwide, and Arctic sea ice and Northern Hemisphere spring snow cover have continued to decrease in extent.

This section presents the regulatory framework for monitoring GHG emissions, as well as a detailed description of national and regional emission sources and trends. In addition, detailed accounts of GHG emissions from stationary and mobile sources at the FCPP and Navajo Mine are provided in the environmental setting. The environmental consequences of the Proposed Action and alternatives with regard to climate change are presented in comparison to the relative contribution of the subject facilities to GHG emissions overall.

4.2.1 Regulatory Compliance Framework

No Federal, tribal, or state rules or regulations currently limit or curtail GHG emissions from FCPP, Navajo Mine, or other sources in the state of New Mexico or Navajo Nation. Federal and tribal stationary source regulations require monitoring, record keeping, and reporting of GHG emissions from FCPP; however, they do not apply to Navajo Mine since it does not meet the definition of a stationary source (i.e., consists of mobile source equipment only). These regulations are briefly described below.

4.2.1.1 Federal Regulations

Mandatory Reporting of Greenhouse Gases Rule (40 CFR Part 98)

On October 30, 2009, the EPA issued the Mandatory Reporting of Greenhouse Gases rule (74 FR 56260, 40 CFR 98, effective December 29, 2009), which requires reporting of GHG data and other relevant information from large sources and suppliers in the U.S. pursuant to Fiscal Year 2008 Consolidated Appropriations Act (HR 2764; Public Law 110-161).

The rule facilitates collection of accurate and comprehensive emissions data to provide a basis for future EPA policy decisions and regulatory initiatives. The rule requires specified industrial source categories and facilities with an aggregated heat input capacity of 30 mmBTU or more per hour or that emit 25,000 metric tonnes or more per year (MT/yr) of CO_2 equivalent (CO_2e) GHGs to submit annual reports to the EPA. The gases covered by the rule are CO_2, CH_4, N_2O, and hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride (SF_6), and other fluorinated gases including nitrogen trifluoride and hydrofluorinated ethers.

As a Title V Operating Permit (40 CFR Part 71) source and Title IV Acid Rain Permit (40 CFR Part 72) source, FCPP is also required to report GHG emissions to the tribal and Federal EPA under Part 98 Subpart D for privately and publicly owned fossil-fuel fired electric generating units, including units located on sovereign tribal lands. Federal GHG regulations and reporting requirements do not apply to surface coal mining operations. The Navajo Mine is not a “major” source of stationary emissions as defined under the Title V and PSD regulatory programs.

Continuous Emissions Monitoring (40 CFR Part 75)

FCPP is subject to Part 75 requirements for the monitoring, record keeping, and reporting of SO_2, NO_X, and CO_2 emissions, volumetric flow, and opacity data from affected units under the Acid Rain Program pursuant to Sections 412 of the CAA, 42 USC 7401-7671 et seq. Part 75 and the GHG Reporting Rule, 40 CFR Part 98 also sets forth provisions for the monitoring, record keeping, and reporting of NO_X mass emissions, control of which is required to demonstrate compliance with a NO_X mass emission reduction program. For FCPP, this control is consistent with 40 CFR Part 49 – *Source Specific Federal Implementation Plan for Implementing Best Available Retrofit Technology for Four Corners Power Plant: Navajo Nation,* described in detail in Section 4.1, Air Quality.

EPA Proposed Clean Power Plan

In June 2014, EPA issued the “Clean Power Plan” proposal to cut carbon pollution from existing power plants. The proposal establishes state-by-state goals to reduce GHGs by 2030. The focus is on power plants, but states have discretion to meet goals with a combination of industries. The proposed regulation is subject to comment and finalization. Additionally, tribal lands are not given goals at this time. A proposed timetable is suggested for moving into the process with tribes, with July 2017 being when EPA would have a proposed goal for tribal lands. States are given a year to establish programs, with a provision for a 2-year extension; therefore, 2020 is when states are required to have a program in place. Programs for compliance by tribes will likely happen a year or two later, with the compliance timeframe adjusted accordingly. Proposed requirements in the plan were not analyzed in the EIS because of the uncertainties associated with whether the plan will be adopted or modified, and how it would be implemented on the Navajo Nation. Although EPA’s Federal Implementation Plan for Best Available Control Technology for the FCPP did not explicitly include GHG reductions, the option selected by APS would reduce GHG emissions from FCPP by 26 percent compared to levels in 2005 (the baseline for the Clean Power Plan).

4.2.1.2 State Rules

Since FCPP and Navajo Mine are located on Navajo Nation sovereign tribal lands, they are not subject to state GHG reduction policies contained in or developed through Executive Orders. Similarly, state rules and regulations do not apply to FCPP or Navajo Mine due to tribal sovereignty. However, they do apply to other sources of GHG in the region, which are described in Section 4.2.2.3, Emission Sources. As such, the state regulatory framework is described in the following.

Executive Order 2009-047

On December 7, 2009, the Governor of New Mexico signed Executive Order 2009-047 *Establishing New Mexico as a Leader in Addressing Climate Change* that directed new emission reduction strategies to address climate change in New Mexico (New Mexico Governor 2009). This order built on actions taken in 2006 pursuant to Executive Order 2006-069 *New Mexico Climate Change Action*, in which the Governor directed state agencies to follow several recommendations of the Climate Change Advisory Group (New Mexico Governor 2006). The 2009 Order maintains a state government implementation team that is tasked with ensuring policies from the order are carried out. Those policies include:

- Continuing to participate in the Western Climate Initiative to develop a regional GHG emission reduction program that addresses the unique characteristics of New Mexico;
- Working with the State’s electrical utilities and stakeholders to develop recommendations for reducing GHG emissions from existing coal-fired power plants within the State’s jurisdiction;
- Developing recommendations for establishing an emission performance standard for new fossil-fueled generating facilities and new long-term power purchase agreements;
- Developing recommendations for offset protocols that are consistent with the Western Climate Initiative;
- Evaluating mechanisms for quantifying and awarding GHG emission allowances for emission reductions that occur before mandatory state or Federal cap-and-trade programs require such reductions;
- Convening a Resilience Advisory Group to develop a plan for adapting to climate changes; and,
- Strengthening state government efforts to reduce emissions associated with energy use and transportation in state government operations.

The 2009 and 2006 Executive Orders updated an initial 2005 Executive Order (05-33) establishing the New Mexico Climate Change Advisory Group and GHG emission reduction goals originally targeted to meet year 2000 levels by 2012, 10 percent below 2000 levels by 2020, and 75 percent below 2000 levels by 2050 (New Mexico Climate Change Advisory Group 2006).

GHG Reporting, Verification, Cap-and-Trade

On February 6, 2012, the New Mexico Environmental Improvement Board approved the repeal of 20.2.300 New Mexico Administrative Code (Reporting of Greenhouse Gas Emissions), 20.2.301 New Mexico Administrative Code (Greenhouse Gas Reporting Verification Requirements), and 20.2.350 New Mexico Administrative Code (Greenhouse Gas Cap-and-Trade Provisions). The effective date of these repeals was March 14, 2012. Due to the repeals, applicable stationary emissions sources are required to follow 20.2.73 New Mexico Administrative Code in reporting GHG emissions (NMED 2012a).

NMED Title V GHG Reporting Requirements

Pursuant to 20.2.73 New Mexico Administrative Code – Notice of Intent and Emissions Inventory Requirements, GHG emissions data are required to be submitted to NMED from Title V sources subject to permit requirements under 20.2.70 New Mexico Administrative Code (NMED 2012a).

For Title V sources that are not oil and gas facilities, the existing rule requires CO_2 and CH_4 emissions to be quantified and reported in accordance with 40 CFR Part 98. In accordance with NMED GHG reporting and quantification procedures, Title V sources that are not oil and gas facilities shall quantify and report

CO_2 and CH_4 emissions using EPA GHG reports; EPA methods applied to facilities not subject to EPA reporting; NMED procedures; or Best Available Data only for sources lacking quantification methods under EPA methods or NMED procedures. The rule also requires applying EPA methods to facilities not subject to EPA reporting; NMED procedures; or Best Available Data only for sources lacking quantification methods under EPA methods or NMED procedures. The NMED procedures specify or reference acceptable EPA calculation methods and emission factors that Title V source owners must use when preparing GHG emissions data reports for submission to NMED, as specified in 20.2.73 New Mexico Administrative Code (NMED 2012a).

Further, NMED accepts GHG emission reports submitted to EPA pursuant to 40 CFR Part 98 as a method of complying with 20.2.73 New Mexico Administrative Code GHG emissions reporting requirements. Part 98 Subpart D – Electricity Generation, applies to power plants.

4.2.2 Affected Environment Pre-2014

4.2.2.1 Atmospheric Composition

Air is a mixture of constituent gases and its composition varies slightly with location and altitude. For 20th century scientific and engineering purposes, it became necessary to define a standard composition known as the U.S. Standard Atmosphere. In addition to the common gases (nitrogen, oxygen, CO_2, CH_4, hydrogen, N_2O), the atmosphere contains noble or inert gases (argon, neon, helium, krypton, xenon). Radon is also present in low concentrations near ground level in limited geographic areas where it is naturally emitted from certain types of rock and soil. Table 4.2-1 shows the typical composition of dry standard air, which is over 99 percent nitrogen and oxygen (Universal Industrial Gases, Inc. [UIG] 2008; EPA 2012b).

Table 4.2-1 Standard Composition of Dry Air

Principal Gas	Concentration in Air ppmv	Fraction percent
Nitrogen	780,805.00	78.080500
Oxygen	209,440.00	20.944000
Argon	9,340.00	0.934000
Carbon Dioxide	387.69	0.038769
Neon	18.21	0.001821
Helium	5.24	0.000524
Methane	1.81	0.000181
Krypton	1.14	0.000114
Hydrogen	0.50	0.000050
Nitrous Oxide	0.32	0.000032
Xenon	0.09	0.000009
Totals	**1,000,000.00**	**100.000**

The atmosphere consists of five basic altitude zones: troposphere (sea level to 8 miles above the Earth's surface); stratosphere (8 to 32 miles); mesosphere (32 to 50 miles); thermosphere (50 to 350 miles); and exosphere (350 to 500 miles). Within the stratosphere is the O_3 layer (9 to 22 miles), which absorbs ultraviolet wavelengths; and within the mesosphere is the ionosphere (62 to 190 miles), which reflects shortwave radio signals and produces auroras. These approximate altitude ranges vary with latitude, season, solar activity, and turbulence. GHGs persist mainly in the troposphere and stratosphere (some in the mesosphere) for different lengths of time, ranging from less than 5 years to over 50,000 years, which is long enough to become well-mixed, meaning that atmospheric concentrations are about the same all over the world, regardless of source locations (EPA 2012d). Thus, the homogeneous composition of the lower atmosphere is the global setting for climate change.

4.2.2.2 Greenhouse Gases

Principal GHGs include CO_2, CH_4, N_2O, hydrofluorocarbons, perfluorocarbons, SF_6, and other fluorinated gases, including nitrogen trifluoride and hydrofluorinated ethers. GHGs occur naturally because of volcanoes, forest fires, and biological processes such as enteric fermentation and aerobic decomposition. They are also produced by combustion of fuels, industrial processes, agricultural operations, waste management, and land use changes such as loss of farmland to urbanization. The most common GHG from human activity (fuel combustion) is CO_2, followed by CH_4 and N_2O (EPA 2012d).

Larger GHG emissions lead to higher concentrations of GHGs in the atmosphere. GHG concentrations are measured in units of ppm, ppb, and parts per trillion (ppt). One ppm is equivalent to 1 cubic centimeter (cc) of pure gas diluted in 1 cubic meter of air. Similarly, 1 ppb is one cc diluted in 1,000 cubic meters, and 1 ppt is one cc diluted in 1,000,000 cubic meters (EPA 2012d).

Carbon Dioxide

CO_2 enters the atmosphere through burning fossil fuels (coal, natural gas, and petroleum products), decomposition of solid waste, trees and wood products, fermentation, and also as a result of certain chemical reactions, such as manufacture of cement. CO_2 is removed from the atmosphere (or "sequestered") when it is absorbed by plants as part of the biologic carbon cycle. In the carbon cycle, carbon in various molecular forms is cycled among atmospheric, oceanic, land and marine biotic, and mineral reservoirs. Atmospheric CO_2 is part of this global carbon cycle. CO_2 concentrations in the atmosphere have increased from about 280 ppm in pre-industrial times to about 390 ppm, a 39 percent increase. The IPCC notes that “this concentration has not been exceeded during the past 420,000 years, and likely not during the past 20 million years. The rate of increase over the past century is unprecedented, at least during the past 20,000 years.” The IPCC definitively states that “the present atmospheric CO_2 increase is caused by anthropogenic emissions of CO_2” (EPA 2012d, IPCC 2007).

Global Warming Potential (GWP) is a quantified measure of the globally averaged relative radiative forcing impacts of a particular GHG. It is defined as the cumulative radiative forcing both direct and indirect effects integrated over a period of time from the emission of a unit mass of gas relative to a reference gas. CO_2 is the reference gas with a GWP of unity (1). CO_2e are calculated by multiplying the mass emissions of each GHG species times its EPA official GWP coefficient, then adding the resultant products together to obtain a single value for CO_2e. The persistence of CO_2 in the atmosphere is estimated to be in the range of 50 to 200 years, depending on variations in the carbon cycle (EPA 2012b, d).

Methane

CH_4 is primarily produced through anaerobic decomposition of organic matter in biological systems. Agricultural processes such as wetland rice cultivation, enteric fermentation in ruminant animals (e.g., cows), and the decomposition of animal wastes emit CH_4, as does the decomposition of municipal solid wastes. CH_4 is also fugitively emitted during the production and distribution of natural gas and petroleum, and is released as a by-product of coal mining and incomplete fossil fuel combustion. Pipeline-quality natural gas is over 90 percent CH_4 by volume and is considered a “clean fuel” by industry with CO_2 and water vapor as its main combustion by-products. Atmospheric CH_4 concentrations have increased by about 160 percent since pre-industrial times, although the rate of increase has been declining. It has been estimated that slightly more than half of the current CH_4 flux to the atmosphere is anthropogenic, from human activities such as agriculture, fossil fuel use, and waste disposal. The EPA’s official GWP coefficient of CH_4 is 21, and its persistence in the atmosphere is estimated to be about 9 to 15 years (EPA 2012b, d).

Nitrous Oxide

N_2O is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste. Anthropogenic sources of N_2O emissions include agricultural soils, especially the use of synthetic and manure fertilizers; fossil fuel combustion, especially from mobile combustion; adipic (nylon) and nitric acid production; wastewater treatment and waste combustion; and biomass burning. N_2O's atmospheric concentration has increased by about 19 percent since 1750, from a pre-industrial value of about 270 ppb to about 320 ppb today, a concentration that has not been exceeded during the last thousand years. The EPA's official GWP coefficient of N_2O is 310, and its persistence in the atmosphere is estimated to be about 110 to 120 years (EPA 2012b, d).

Fluorinated Gases

Hydrofluorocarbons, perfluorocarbons, and SF_6 are synthetic, powerful GHGs that are emitted from a variety of industrial processes. Fluorinated gases are sometimes used as substitutes for O_3-depleting substances (e.g., chlorofluorocarbons, hydrochlorofluorocarbons, and halons). In the electric utility industry, SF_6 is used as a dielectric gas in high-voltage equipment, such as switchgear and circuit breakers. As a man-made gas, SF_6 in the atmosphere has increased from 0 to about 7 ppt in modern times. Due to their expense, all of these fluorinated gases are typically emitted (lost) in small quantities relative to combustion by-products, but because they are potent GHGs, they are sometimes referred to as "High GWP gases" with estimated persistence in the atmosphere ranging from 1.5 to 50,000 years. Of these, SF_6 is the most potent, with an EPA official GWP of 23,900 and an estimated persistence of about 3,200 years (EPA 2012b, d).

4.2.2.3 Emission Sources

The EPA tracks GHG emissions in the U.S. and publishes the *Inventory of U.S. Greenhouse Gas Emissions and Sinks*, which is updated annually (EPA 2012b, 2014). This detailed report contains estimates of the total national GHG emissions and removals associated with human activities in all 50 states. From the current report, the main sources of GHG emissions in the U.S. are described below (EPA 2014b):

- Electric power generation accounts for 32 percent of GHG emissions nationwide. Over 70 percent of electric power is generated by burning fossil fuels, mainly coal and natural gas. GHG emissions from electric power generation in the U.S. have increased by about 24 percent since 1990 as demand for electric power has grown, and fossil fuels have remained the dominant energy source for generation due to their low cost and high reliability.
- Transportation accounts for 28 percent of GHG emissions nationwide. GHG emissions from transportation result from burning fossil fuels in automobiles, trucks, trains, ships, and aircraft. About 90 percent of the fuel used for transportation is petroleum-based, which includes gasoline, diesel, and jet fuel.
- Industry accounts for 20 percent of GHG emissions nationwide. GHG emissions from industry are associated mainly with burning fossil fuels (coal, natural gas) for heat energy as well as emissions from certain chemical reactions necessary to produce goods from raw materials.
- Commercial and Residential uses account for 10 percent of GHG emissions nationwide. GHG emissions from businesses and homes result primarily from fossil fuels burned for heat, the use of certain products that contain GHGs, and the handling and disposal of domestic wastes.
- Agriculture accounts for 10 percent of GHG emissions nationwide. GHG emissions from agriculture are primarily caused by livestock such as cows (enteric fermentation), soil management practices, and rice farming.
- Land Use and Forestry offsets (absorbs or sequesters) about 15 percent of GHG emissions nationwide. Land areas can act as GHG sinks (absorbing CO_2 from the atmosphere) or GHG

sources. Since 1990, well-managed forests and other lands have absorbed more CO_2 from the atmosphere than they emit.

4.2.2.4 Emission Trends

Since 1990, GHG emissions in the U.S. have increased by about 4.7 percent. However, from year-to-year emissions can increase or decrease due to changes in the economy, the price of fuel, weather, and other factors. In 2010, overall GHG emissions increased about 3 percent from 2009 levels. This increase was attributed to the improving economy, which increased energy consumption across all sectors. In addition, a hot summer caused an increase in electric power demand for air conditioning that was generated mainly by burning coal and natural gas in existing power plants (EPA 2014b).

4.2.2.5 Electric Power Generation

The electric utility sector involves the generation, transmission, and distribution of electricity. CO_2 comprises the vast majority (over 99 percent) of GHG emissions from this sector, but small amounts of CH_4 and N_2O are also emitted. These gases are released during the combustion of fossil fuels, such as coal, oil, and natural gas, to generate electricity. Less than 1 percent of GHGs from this sector is in the form of SF_6, a dielectric (insulating) gas used in high-voltage transmission and distribution equipment, such as circuit breakers and switches (EPA 2012b, d).

Coal combustion is much more carbon-intensive than burning natural gas or petroleum to generate electricity. In 2012, consumption of energy generated by coal decreased by 12.3 percent; thus coal generated about 33 percent of electric power in the U.S. and in 2012 accounted for about 40 percent of CO_2 emissions from the power sector (EPA 2014b). In 2011, coal generated about 45 percent of electric power in the U.S., and accounts for 81 percent of CO_2 emissions from this sector. About 25 percent of electricity generated in 2010 was generated using natural gas, and this percentage has grown in recent years due to its reputation as a “clean” fuel and increased supply, which has driven down prices. Petroleum accounts for less than 1 percent of electricity generation, down significantly from the past. The remaining generation comes from nuclear plants (about 20 percent) and renewable sources (about 10 percent), which includes hydroelectric, geothermal, biomass (wood and agricultural wastes), wind, and solar (photovoltaic and thermal). Geothermal and biomass sources typically release fewer GHGs than fossil fuel combustion; and hydroelectric, wind, and solar emit no GHGs directly (EPA 2012d).

Table 4.2-2 presents a comparison of the GHG contents of various fuels used for electric power generation in units of kilograms per million BTU[1] (kg/mmBTU). Table 4.2-3 summarizes GHG emission rates for various generating resources in units of kg/MW-hr and pounds per megawatt-hour. The Interim Standard referenced in Table 4.2-3 is per the California PUC Decision No. 07-01-039, January 25, 2007 (SB 1368).

[1] BTU – British Thermal Unit, the amount of heat required to raise the temperature of 1 pound of water 1°F, from 39 to 40°F.

Table 4.2-2 Comparison of Fuel GHG Contents - Thermal Electric Power Generation

Fuel / Heat Source	Generator Drive	GHG Emissions CO_2	GHG Emissions CH_4	GHG Emissions N_2O	GHG Emissions CO_2e
Bituminous Coal (electric utility)	ST	95.52 kg/mmBTU	0.0011 kg/mmBTU	0.0016 kg/mmBTU	96.03 kg/mmBTU
Biomass (wood waste cogeneration)	ST	88.45 kg/mmBTU	0.0316 kg/mmBTU	0.0042 kg/mmBTU	90.42 kg/mmBTU
Residual Fuel Oil No. 6	ST	75.09 kg/mmBTU	0.0032 kg/mmBTU	0.0006 kg/mmBTU	75.36 kg/mmBTU
Diesel Fuel No. 2	ICE, CT	73.96 kg/mmBTU	0.0032 kg/mmBTU	0.0006 kg/mmBTU	74.22 kg/mmBTU
Pipeline Natural Gas	ICE, CT, ST	53.02 kg/mmBTU	0.0011 kg/mmBTU	0.0001 kg/mmBTU	53.07 kg/mmBTU
Geothermal	ST	7.52 kg/mmBTU	0.0000 kg/mmBTU	0.0000 kg/mmBTU	7.52 kg/mmBTU
Solar Thermal	ST	0.00 kg/mmBTU	0.0000 kg/mmBTU	0.0000 kg/mmBTU	0.00 kg/mmBTU
Nuclear	ST	0.00 kg/mmBTU	0.0000 kg/mmBTU	0.0000 kg/mmBTU	0.00 kg/mmBTU

Sources: EPA 2012b, 2011a.

Notes:

BTU = the amount of energy (heat) required to raise 1 pound of liquid water 1 degree Fahrenheit in temperature (39 to 40°F)

CT = combustion turbine (simple cycle or combined cycle), also referred to as gas turbine

ICE = internal combustion engine (diesel compression ignition or gas spark ignition), also referred to as reciprocating engine

kg/mmBTU = kilogram(s) per million British Thermal Units

ST = steam turbine (multistage), requires boiler

Table 4.2-3 Comparison of Electric Power Generation GHG Rates

Generating Units	CO_2e Rates kg/MW-hr	CO_2e Rates lb/MW-hr	Percent of Standard
Conventional Gas-Fired Turbine[1]	533	1,175	107%
Interim Standard[2]	499	1,100	100%
Combined Cycle Gas-Fired[3]	377	832	76%
Geothermal[4]	107	236	21%
Solar Thermal or Nuclear	0	0	0%

Sources: EPA 2012b, h.

Notes:

[1] Conventional gas-fired is steam turbine or simple-cycle gas turbine, 34% efficiency.

[2] California PUC Decision No. 07-01-039, January 25, 2007 (SB 1368).

[3] Combined cycle is gas turbine with steam turbine, 48% composite efficiency.

[4] Saturated steam, 24% efficiency (no superheat).

kg/MW-hr = kilogram(s) per megawatt-hour (same as grams per kilowatt-hour)

lb/MW-hr = pound(s) per megawatt-hour

4.2.2.6 Mobile Sources

While stationary sources such as power plants and oil refineries emit large quantities of GHGs due to their sheer numbers nationwide, mobile sources also emit substantial amounts. Mobile sources include on-road vehicles (e.g., automobiles, trucks, motorcycles), off-road equipment (e.g., earthmovers, cranes, portable pumps and generators), trains (e.g., freight, passenger, light rail), vessels (e.g., boats, ships, watercraft), and aircraft (e.g., general aviation, commercial, military). Mobile source fuels include gasoline, diesel, heavy fuel oil, and jet fuel, all of which emit GHGs when combusted.

Mobile sources associated with Navajo Mine include diesel-powered draglines, loaders, coal haul trucks, support vehicles, and explosives detonation. Mobile sources associated with FCPP include materials handling equipment, maintenance equipment, and support vehicles used at the plant and for transmission line upkeep. The dominant fuel used for mobile sources at Navajo Mine and FCPP is diesel fuel, also referred to as distillate fuel oil no. 2, with a calculated GHG content of 22.4 pounds per gallon CO_2e.

4.2.2.7 Regional and State GHG Emissions

There are 17 electric power-generating facilities in the Four Corners region (northeastern Arizona, southwestern Colorado, Navajo Nation, and northwestern New Mexico) including FCPP that report to U.S. and tribal EPAs pursuant to Part 75 (Table 4.2-4). No generating facilities in southeastern Utah are within an equivalent distance of 400 km (248 miles). These sources are identified in order to provide context regarding regional GHG emissions and their portion of national GHG emissions resulting from electric power generation. Table 4.2-5 summarizes historic GHG emissions reported to, and published by, EPA for the most recent 6-year period (2005 to 2010) from electric power generation on national, regional (17 plants, including FCPP), and local (FCPP only) levels. At the New Mexico state level, Table 4.2-6 shows reported statewide industrial GHG emissions from all sources for 2008, 2009, and 2010, the most recent figures available, with FCPP Part 75 data included for geographic context.

Table 4.2-4 Regional Part 75 Sources - 17 Electric Power Generating Facilities

State	Facility Name	Facility Label	ORISPL	Fuel	County
Arizona	Cholla	Generating Station	113	Coal	Navajo
Arizona	Coronado	Generating Station	6177	Coal	Apache
Navajo Nation	Navajo	Generating Station	4941	Coal	Coconino
Arizona	Springerville	Generating Station	8223	Coal	Apache
Colorado	Comanche	Generating Station	470	Coal	Pueblo
Colorado	Fountain Valley	Power Plant	55453	Gas	El Paso
Colorado	Front Range	Power Plant	55283	Gas	El Paso
Colorado	Martin Drake	Generating Station	492	Coal	El Paso
Colorado	Nucla	Generating Station	527	Coal	Montrose
Navajo Nation	FCPP	Steam Electric Station	2442	Coal	San Juan
New Mexico	Bluffview	Power Plant	55977	Gas	San Juan
New Mexico	Escalante	Generating Station	87	Coal	McKinley
New Mexico	Milagro	Cogeneration and Gas Plant	54814	Gas	San Juan
New Mexico	Person	Generating Project	55039	Gas	Bernalillo
New Mexico	Reeves	Generating Station	2450	Gas	Bernalillo
New Mexico	San Juan	Generating Station	2451	Coal	San Juan
New Mexico	Valencia	Power Plant	55802	Gas	Valencia

Table 4.2-5 Historic GHG Emissions from Electric Power Generation

Summary Year	U.S. Total[1] MMT CO_2e	National Plants MMT CO_2e	Regional Plants MMT CO_2e	FCPP MMT CO_2e	FCPP Percent of National Emissions	FCPP Percent of Regional Emissions
2005	7,204	2,419	75.67	14.61	0.60%	19.3%
2006	7,159	2,363	76.79	14.96	0.63%	19.5%
2007	7,253	2,430	76.75	13.76	0.57%	17.9%
2008	7,048	2,378	76.67	13.70	0.58%	17.9%
2009	6,608	2,164	77.06	14.67	0.68%	19.0%
2010	6,822	2,277	76.78	13.14	0.58%	17.1%
6-Year Average	**7,016**	**2,339**	**76.62**	**14.14**	**0.60%**	**18.5%**
Annual Variation	**2.9%**	**3.4%**	**0.4%**	**4.3%**	**—**	**—**
Percent of Total US GHG Emissions	**100.0%**	**33.3%**	**1.1%**	**0.2%**	**—**	**—**

Sources: EPA 2012b,h.

Notes:
[1]all emissions sources
Percentages represents the percent of electrical power generation emissions
1 metric tonne = 1,000 kilograms or 2,204.6 pounds
CO_2e = carbon dioxide equivalents
MMT = million metric tonnes

Table 4.2-6 Reported Statewide Industrial GHG Emissions - New Mexico[1]

Standard Industrial Classification	2008 MMT CO_2e	2009 MMT CO_2e	2010 MMT CO_2e	3-Year Average MMT CO_2e	3-Year Average percent
Electricity Generation - FCPP[2]	13.697	14.671	13.135	13.834	34.8%
Electricity Generation - San Juan[3]	10.797	12.167	10.731	11.232	28.2%
Electricity Generation - Other Plants[3]	4.899	5.632	5.665	5.398	13.6%
Electricity Generation - Subtotals	*29.393*	*32.470*	*29.531*	*30.465*	*76.6%*
Oil and Gas Extraction	1.001	1.220	1.043	1.088	2.7%
Oil and Gas Field Services	2.100	2.404	2.042	2.182	5.5%
Natural Gas Liquids	3.048	3.352	3.430	3.277	8.2%
Natural Gas Transmission	0.818	1.332	1.147	1.099	2.8%
Oil and Gas – Subtotals	*6.967*	*8.308*	*7.662*	*7.646*	*19.2%*
Petroleum Refining	1.086	0.995	1.190	1.090	2.7%
Petroleum Pipelines	0.066	0.069	0.059	0.065	0.2%
Refining and Pipelines - Subtotals	*1.152*	*1.064*	*1.249*	*1.155*	*2.9%*
Potash Mining	0.150	0.104	0.115	0.123	0.31%
Copper Mining	0.088	0.000	0.0002	0.029	0.07%
Gypsum Products	0.037	0.019	0.067	0.041	0.10%
Mining and Minerals - Subtotals	*0.275*	*0.123*	*0.182*	*0.193*	*0.5%*
Dry Dairy Products	0.051	0.037	0.030	0.039	0.10%
National Security	0.032	0.064	0.000	0.032	0.08%
Universities	0.027	0.032	0.036	0.032	0.08%
Landfills	0.006	0.248	0.398	0.217	0.55%
Plastic Foam Products	0.001	0.0004	0.0005	0.001	0.002%
Other Sources – Subtotals	*0.117*	*0.381*	*0.465*	*0.321*	*0.8%*
Annual Totals	**37.904**	**42.346**	**39.089**	**39.780**	**100.00%**

Source: NMED 2012b; EPA 2012b, d.

Notes:

[1] Most recent state data available (June 2012).

[2] Navajo Nation, does not appear on state inventory (EPA data).

[3] Included in state inventory.

CO_2e = carbon dioxide equivalents

MMT = million metric tonnes (1 metric tonne = 1,000 kilograms or 2,204.6 pounds)

As shown in Table 4.2-6, electric power generation, including FCPP, comprised 76 percent of GHG emissions in geographic New Mexico during the 2008 to 2010 reporting period. Of electrical power generation emissions, FCPP contributed 45 percent, the San Juan Generating Station contributed 37 percent, and other plants contributed 18 percent. Thus, FCPP was the largest emitter of GHGs in the geographic state during the reporting period.

4.2.2.8 FCPP Stationary Source GHG Emissions

For the representative 12-year[2] period 2000 to 2011, Table 4.2-7 shows historic plantwide generation (MW-hrs/yr), GHG emissions (MT/yr), and GHG rates (kg/MW-hr) from FCPP Units 1, 2, 3, 4, and 5, as reported to EPA pursuant to Part 75[3]. Similarly, Table 4.2-8 sums Units 1, 2, and 3 for the same period, and Table 4.2-9 sums Units 4 and 5. These split GHG data illustrate the relative contributions of the older, less-efficient generating units (1, 2, and 3) and the newer, more-efficient generating units (4 and 5). Table 4.2-10 displays the relative contribution of FCPP to regional electrical generation and GHG emissions.

As shown in Tables 4.2-8 and 4.2-9, historically, Units 1, 2, and 3 generated 29 percent of electric power at FCPP and emitted 33 percent of GHGs, while Units 4 and 5 generated 71 percent of electric power and emitted 67 percent of GHGs. This result demonstrates that Units 4 and 5 are more efficient and have lower GHG emission rates in units of kg/MW-hr. Tables 4.2-8 and 4.2-9 represent total values per year.

Table 4.2-7 Historic Aggregated GHG Emissions - FCPP Units 1, 2, 3, 4, and 5

Year	Generation MW-hrs/yr	CO_2e MT/yr	CO_2e kg/MW-hr
2000	16,109,134	15,452,300	959
2001	16,472,108	15,708,085	954
2002	14,768,989	13,619,193	922
2003	16,857,882	14,862,974	882
2004	16,134,118	13,779,824	854
2005	16,829,089	14,609,268	868
2006	17,162,615	14,956,107	871
2007	15,700,442	13,760,220	876
2008	15,821,299	13,697,313	866
2009	16,804,764	14,670,764	873
2010	14,955,046	13,135,014	878
2011	15,066,283	13,215,996	877
Historic Emissions	16,048,505	14,006,383	873
Plantwide Share	100%	100%	—

Source: EPA 2012b, h.

Notes:

CO_2e = carbon dioxide equivalents

Historic baseline period is 2005-11 (FGD installed on Units 4 and 5)

kg/MW-hr = kilograms per megawatt-hour (same as grams per kilowatt-hour)

MT = 1,000 kg or 2,204.6 lbs

MT/yr = metric tonnes per year

MW-hrs/yr = megawatt-hours per year

[2] The Title V record-keeping requirement is 5 years.

[3] Part 75 CO_2 emissions corrected to CO_2e by multiplying by 1.0055 (average) to account for CH_4 and N_2O emissions with EPA official GWPs applied (21 and 310, respectively).

Table 4.2-8 Historic GHG Emissions - FCPP Units 1, 2, and 3

Year	Generation MW-hrs/yr	CO_2e MT/yr	CO_2e kg/MW-hr
2000	4,550,595	4,643,060	1020
2001	4,642,272	4,860,698	1047
2002	4,664,651	4,700,023	1008
2003	4,503,798	4,311,611	957
2004	4,799,830	4,588,422	956
2005	4,936,157	4,691,541	950
2006	4,683,715	4,500,030	961
2007	4,851,740	4,686,109	966
2008	4,823,075	4,661,488	966
2009	4,780,246	4,566,395	955
2010	4,646,445	4,571,064	984
2011	4,258,209	4,239,444	996
Historic Emissions	4,711,369	4,559,439	968
Plantwide Share	29%	33%	–

Source: EPA 2012b, h.

Notes:

CO_2e = carbon dioxide equivalents

Historic baseline period is 2005-11 (FGD installed on Units 4 and 5)

kg/MW-hr = kilograms per megawatt-hour (same as grams per kilowatt-hour)

MT = 1,000 kg or 2,204.6 lbs

MT/yr = metric tonnes per year

MW-hrs/yr = megawatt-hours per year

Table 4.2-9 Historic GHG Emissions - FCPP Units 4 and 5

Year	Generation MW-hrs/yr	CO_2e MT/yr	CO_2e kg/MW-hr
2000	11,558,538	10,809,239	935
2001	11,829,836	10,847,388	917
2002	10,104,338	8,919,170	883
2003	12,354,084	10,551,363	854
2004	11,334,289	9,191,403	811
2005	11,892,933	9,917,727	834
2006	12,478,900	10,456,077	838
2007	10,848,702	9,074,111	836
2008	10,998,224	9,035,825	822
2009	12,024,518	10,104,369	840
2010	10,308,601	8,563,950	831
2011	10,808,075	8,976,552	831
Historic Baseline	11,337,136	9,446,944	833
Plantwide Share	71%	67%	—

Source: EPA 2012b, h.

Notes:

CO_2e = carbon dioxide equivalents

Historic baseline period is 2005-11 (FGD installed on Units 4 and 5)

kg/MW-hr = kilograms per megawatt-hour (same as grams per kilowatt-hour)

MT = 1,000 kg or 2,204.6 lbs

MT/yr = metric tonnes per year

MW-hrs/yr = megawatt-hours per year

Table 4.2-10 Historic Contribution of FCPP to Regional Electrical Generation and GHG Emissions

Year	Percent of Regional Generation	Percent of Regional CO_2e Emissions
2000	20.2%	20.3%
2001	20.8%	20.6%
2002	18.9%	18.2%
2003	21.1%	20.1%
2004	19.6%	18.6%
2005	20.0%	19.3%
2006	19.9%	19.5%
2007	18.1%	17.9%
2008	18.7%	17.9%
2009	20.0%	19.0%
2010	17.3%	17.1%
2011	17.1%	16.7%
2012	Data Not Available	Data Not Available
2013	Transition Period	Transition Period

Sources: EPA 2012b, g, h.

Notes:

For 17 regional electric power producers in Arizona, Colorado, Navajo Nation, and New Mexico, 2000-11 historic data.

CO_2e = carbon dioxide equivalents

4.2.2.9 FCPP and Navajo Mine Mobile Source GHG Emissions

Mobile GHG emissions from the Navajo Mine and FCPP result from support vehicles and equipment in the form of fugitive CH_4 and engine exhaust. Table 4.2-11 summarizes these emissions. In comparison to stationary source GHG emissions from FCPP, mobile and fugitive source GHG emissions comprise a small fraction of total Project GHG emissions, only 0.5 percent of total Project GHG emissions, and is very small compared to regional and global emissions.

Fugitive GHG emissions from the Navajo Mine shown in Table 4.2-11 summarize data from the Area IV North Mine Plan Revision EA (OSMRE 2012a). GHG emissions are conservative, because they were based on a prior production rate of approximately 8.5 million tpy and the Proposed Action is for a reduced production rate of approximately 6 million tpy.

Table 4.2-11 Estimated GHG Emissions from Navajo Mine and FCPP Mobile and Fugitive Sources

Mobile and Fugitive Sources	CO_2 MT/yr	CH_4 MT/yr	N_2O MT/yr	CO_2e MT/yr
Mine Extraction Operations and Loading	7,557	5.18	2.32	8,385
Coal Hauling Trucks to Stockpiles	2,010	0.11	0.05	2,028
Mining Support Vehicle Travel	2,134	0.11	0.04	2,150
Mine Fugitive Methane Emissions	—	2,747	—	57,687
Power Plant Off-road Equipment	149	0.01	0.00	151
Power Plant On-road Vehicles	160	0.01	0.01	162
Annual Totals (rounded)	12,010	2,750	2	70,560

Sources: OSMRE 2012a; APS 2012a; EPA 2012b, 2011; SCAQMD 2008.

Notes:
CH_4 = methane
CO_2 = carbon dioxide
CO_2e = carbon dioxide equivalents
MT = 1,000 kg or 2,204.6 lbs
MT/yr = metric tonnes per year
N_2O = nitrous oxide

A September 2014 study based on data collected by a new satellite-based CH_4 monitoring system found relatively higher levels of CH_4 in the atmosphere over the Four Corners region than elsewhere in the Southwest (referred to as a "methane hot spot"). A period of validating the observations is necessary; however, limited ground-based measurements appear to corroborate the space-based findings. The study primarily attributed the CH_4 levels to natural gas production, processing, and distribution, noting that "[oil and gas] Operators in Four Corners report higher emissions than any other basin in the new U.S. Environmental Protection Agency (EPA) greenhouse gas reporting program (GHGRP) subpart W [U.S. Environmental Protection Agency, 2013]." Although the study notes other sources of CH_4, such as coal mining and ruminant animals, the study focuses on oil and gas extraction and proposed increases in shale gas production in the area as the source of elevated CH_4 levels. The study does not change the regional baseline information, which is based on 12 years of historic data; therefore, the CH_4 analysis presented in the Final EIS is the most relevant background data for the impact analysis. Additionally, the Navajo Mine CH_4 emissions total less than 1 percent of the total CH_4 emissions in the Four Corners area, which is consistent with the findings of the recent study that oil and gas production, primarily coal-bed methane extraction, is the likely cause of the anomaly noted in the study.

4.2.3 Changes to Climate Change Affected Environment Post-2014

4.2.3.1 FCPP Stationary Source Emissions

GHG Reductions Attributable to BART Compliance

In order to comply with EPA's FIP specifying BART for the FCPP, APS has selected to implement the following actions:

- Shut down Units 1, 2, and 3. This shutdown occurred December 30, 2013.
- Continue to operate Units 4 and 5 for the duration of the lease agreement, with the addition of SCR equipment. APS will install "hot side/high dust" SCRs between the boiler economizer and secondary air preheater on Units 4 and 5.

These actions, considered in this EIS as part of the environmental baseline, will produce a substantial reduction in the GHG emissions from FCPP. The expected timing of the reduction is from January 2014 to July 2018. Under the baseline conditions, GHG emissions from the FCPP are reduced by 26 percent (Table 4.2-12). Tables 4.2-10 and 4.2-15 show that as a result of the annual GHG emission reductions from BART compliance, the percentage contribution of FCPP to regional GHG emissions will decrease from 16.7 percent to a little over 12 percent.

Table 4.2-12 Annual Reduction in GHG Emissions as a Result of BART Compliance.

	CO_2e MT/yr	CO_2e kg/MW-hr
Units 1, 2, 3, 4, 5	14,006,383	873
Units 4 and 5 (with SCR, operating at maximum capacity)	10,339,030	833
Total Reduction	3,667,353	40
Percent Reduction	26%	5%

Notes:
CO_2e = carbon dioxide equivalents
kg/MW-hr = kilograms per megawatt-hour (same as grams per kilowatt-hour)
MT = 1,000 kg or 2,204.6 lbs
MT/yr = metric tonnes per year

4.2.3.2 FCPP and Navajo Mine Mobile Source GHG Emissions

No changes to mobile source GHG emissions are anticipated to occur as a result of compliance with the FIP.

4.2.4 Environmental Consequences

The CEQ provided draft guidance on addressing climate change in NEPA documents in 2010. In this guidance, the CEQ states that, “in the agency’s analysis of direct effects, it would be appropriate to: 1) quantify cumulative emissions over the life of the project; 2) discuss measures to reduce GHG emissions…., and 3) qualitatively discuss the link between such GHG emissions and climate change.”

In part to provide a unified federal approach to climate change analysis in NEPA, the CEQ published additional draft guidelines in December 2014 on incorporating climate change analysis into NEPA documents. The EIS is responsive to the new guidance because it contains: 1) effects of climate change on regional resources including the Project; 2) consideration of alternatives to mitigate the effects of climate change; 3) consideration of both long-term and short-term effects and benefits; and 4) provides a full emissions monetization.

This section presents the results of the quantitative assessment of potential future GHG emissions from FCPP, Navajo Mine (both the Navajo Mine Permit Area and proposed Pinabete SMCRA Permit Area), and compares them to the emissions of the 16 other power plants in the region for the 25-year life of the lease from 2016 to 2041. This comparison is made in order to provide context for the GHG emissions from the action alternatives on a regional level.

In the assessment of environmental consequences, the analysis considers reductions in GHG emissions as a result of BART compliance as the environmental baseline. Consequences are evaluated based on the operation of Units 4 and 5 alone, as well as the mobile source emissions. The shutdown of Units 1, 2, and 3 represents a loss of about 4,711,000 MW-hrs of annual generation capacity from FCPP, based on historic operating data. However, there would be no net reduction in the amount of generation capacity available to the owners of FCPP, because the purchase of SCE’s share of Units 4 and 5 more than offsets the lost generation from shutting down Units 1, 2, and 3. Any replacement generation that Southern California Edison seeks to develop would be subject to California's Climate Change Law, AB32. This law requires reductions in GHG emissions from generation sources that supply the state, and as such would address any consequences of replacement generation.

Predicted emissions from FCPP and 16 other regional plants are based on historic operating data reported to the EPA referencing the 7-year historic baseline period of 2005 to 2011 when FGD becomes active on Units 4 and 5. It is necessary to define this historic baseline period because FGD affects boiler performance by a small amount, mainly due to increased exhaust backpressure. In turn, turbine-generator output is affected by a small amount (CARB 2012).

The 40 CFR 98 Subpart D electricity generation source category comprises generating units (i.e., individual boiler-turbine-generator systems) that are required to monitor and report to EPA CO_2 emissions year-round. Normally this monitoring is accomplished using a fuel emission factor. For FCPP, the Part 75 CO_2 emission factor is fixed at 205 pounds CO_2 per mmBTU heat input for the bituminous coal combusted in the boilers. For this analysis, an EPA-referenced correction factor is applied to account for CH_4 and N_2O and convert to CO_2e using GWPs. For FCPP, this correction factor is 1.0055, which means that 0.55 percent is added to reported 40 CFR Part 98 CO_2 emissions to obtain CO_2e.

Key concepts in projecting future emissions are capacity factor and PTE, as defined below:

- Capacity factor is defined as actual utilization divided by theoretical design capacity. For generating units, this factor is typically expressed as actual MW-hrs generated in a year versus design rating in megawatts times 8,760 hours per year (maximum theoretical MW-hrs). Since generating units must be periodically shut down for maintenance and seldom operate at full design rating (load) to extend equipment life, capacity factor is always less than 100 percent, typically in the range of 80 to 95 percent for base load generating units, depending on overall reliability.
- PTE is defined as maximum theoretical emissions for a pollutant at permitted operating conditions. Traditionally, PTE is determined assuming maximum allowable emission rate at 100 percent capacity factor; however, since actual capacity factor is less than 100 percent, theoretical PTE is never normally achieved unless limited by permit condition.

In addition, on-road vehicles and off-road equipment owned by FCPP are used for plant and switchyard maintenance. Segments of the transmission lines nearest FCPP are also maintained using plant vehicles and equipment. These vehicles and equipment emit air contaminants in engine exhaust during normal use. All equipment and vehicle engines used at the plant meet Federal emissions standards applicable on the date of manufacture.

Mining activity would also cause emissions from diesel-powered off-road equipment and on-road vehicles, explosives detonation, fugitive methane CH_4 liberated from coal seams, and fugitive dust. All equipment and vehicle engines used at the mine meet Federal emissions standards applicable on the date of manufacture. In comparison to stationary source GHG emissions from FCPP, mobile and fugitive source GHG emissions comprise a small fraction of total Project GHG emissions, only 0.5 percent of total GHG emissions. This percentage is within EPA limits of precision of -2 to +5 percent for fossil fuel combustion (EPA 2012b). Therefore, GHG emissions from power plant stacks such as FCPP and San Juan Generating Station can be used as a general measure of overall GHG emissions from all sources at such mine-and-plant facilities: mobile, fugitive, and stationary. This corollary enables general assessments and comparisons of facility-wide emissions based on Part 75 data without the need to conduct detailed emissions inventories of mining and support operations. Therefore, estimated mining emissions are cited from the referenced FONSI (OSMRE 2012b).

Finally, in response to comments received during scoping regarding the potential costs to society of future GHG emissions, a qualitative discussion is provided in the impact assessment below.

4.2.4.1 Alternative A - Proposed Action

FCPP and Navajo Mine emit GHGs and, therefore, contribute incrementally to climate change; however, as described in Section 4.2.1.2, these emissions comprise less than 1 percent of the U.S. GHG inventory and the national electric power sector. This fact precludes meaningful quantification of the effects that FCPP and Navajo Mine operations may specifically have on climate, although taken together with regional, national, and worldwide GHG emissions, global effects are as described in Section 4.2.1.2.

Stationary Sources

Table 4.2-13 shows estimated future (2014 through 2041) potential GHG emissions from Units 4 and 5 assuming a maximum (worst-case) annual generation capacity factor of 92 percent based on the 7-year baseline period from 2005 to 2011 when FGD became active on Units 4 and 5. To be conservative, this 92 percent capacity factor is 8 percent higher than the historic average of 84 percent for the baseline period. For the 12-year period beginning in 2000, a 92 percent capacity factor was achieved only during 2 years, 2003 and 2006, all other years were less. Thus, the probability of achieving a 92 percent capacity factor is estimated to be 1 in 6 or about 17 percent overall, which is a reasonable contingency over the long run.

Table 4.2-14 shows estimated future regional GHG emissions and composite rates for the 17 regional electric power producers in Arizona, Colorado, Navajo Nation, and New Mexico, including FCPP. These projections for 2016 through 2041 are based on the following assumptions; however, actual future occurrences may differ from predictive estimates:

- *2014:* Regional emissions are about 3 percent greater than in 2011 based on the 95th percentile of historic rates and improving economic conditions.
- *2014 to 2016:* APS operates FCPP Units 4 and 5 at historic 84 percent annual capacity factor and regional GHG emissions grow due to load demand growth on underutilized capacity at an annual rate of 0.75 percent calculated from historic GHG emissions data during the 7-year baseline period 2005 to 2011.
- *2017:* APS installs the first SCR on Unit 4 or 5, thus reducing annual NO_X emissions by about 6,600 tons. Annual emissions are mainly from the other operating unit, which would be retrofitted the following year. Regional load demand growth continues.
- *2018:* APS installs the second SCR on Unit 4 or 5, thus reducing annual NO_X emissions by about another 6,600 tons, mainly from the other operating unit, which was retrofitted in the prior year. Regional load demand growth continues.
- *2019:* APS operates Units 4 and 5 at an historic 84 percent annual capacity factor, thus reducing annual NO_X emissions by an additional 6,600 tons from pre-Project levels since both retrofitted units would be operating full-time with lowered NO_X emissions. Total average annual NO_X reduction is about 19,800 tons in future years compared to typical pre-Project levels. Regional load demand growth continues.
- *2020 and beyond:* Regional load demand growth is assumed to “top out” at about 5 percent above the historic 95th percentile, which represents a “mature” system notwithstanding construction of new regional generating capacity in the future.

Table 4.2-15 shows the relative annual contribution of FCPP to regional generation and GHG emissions from 2014 to 2041 (estimated). As shown in the table, FCPP would contribute approximately 12 percent of GHG emissions in the region resulting from electrical power generation. This table does not account for GHG emissions from other sources in the region (i.e., oil and gas development, other mining operations).

Table 4.2-13 Estimated Annual Future Potential GHG Emissions - Units 4 and 5

Year	Generation MW-hrs/yr	CO_2e MT/yr	CO_2e kg/MW-hr
2014	12,410,900	10,339,030	833
2015	12,410,900	10,339,030	833
2016	12,410,900	10,339,030	833
2017	12,410,900	10,339,030	833
2018	12,410,900	10,339,030	833
2019	12,410,900	10,339,030	833
2020	12,410,900	10,339,030	833
2021	12,410,900	10,339,030	833
2022	12,410,900	10,339,030	833
2023	12,410,900	10,339,030	833
2024	12,410,900	10,339,030	833
2025	12,410,900	10,339,030	833
2026	12,410,900	10,339,030	833
2027	12,410,900	10,339,030	833
2028	12,410,900	10,339,030	833
2029	12,410,900	10,339,030	833
2030	12,410,900	10,339,030	833
2031	12,410,900	10,339,030	833
2032	12,410,900	10,339,030	833
2033	12,410,900	10,339,030	833
2034	12,410,900	10,339,030	833
2035	12,410,900	10,339,030	833
2036	12,410,900	10,339,030	833
2037	12,410,900	10,339,030	833
2038	12,410,900	10,339,030	833
2039	12,410,900	10,339,030	833
2040	12,410,900	10,339,030	833
2041	12,410,900	10,339,030	833
25-Year Cumulative Emissions	**310,272,500**	**258,475,750**	**—**

Sources: EPA 2012b, g, h.

Notes:

Assumes maximum future annual capacity factor for Units 4 and 5 based on historic operating data; Values rounded to nearest 100 metric tonnes (MT); 25-year cumulatives are for 2017-2041 (inclusive).

CO_2e = carbon dioxide equivalents
kg/MW-hr = kilograms per megawatt-hour (same as grams per kilowatt-hour)
MT = 1,000 kg or 2,204.6 lbs
MT/yr = metric tonnes per year
MW-hrs/yr = megawatt-hours per year

Table 4.2-14 Estimated Annual Future Regional GHG Emissions and Composite Rates

Year	Generation MW-hrs/yr	CO_2e MT/yr	CO_2e kg/MW-hr
2014	90,385,600	81,290,800	899
2015	91,101,000	81,903,400	899
2016	91,822,100	82,520,700	899
2017	92,548,900	83,142,600	898
2018	93,281,500	83,769,200	898
2019	94,019,900	84,400,500	898
2020	94,764,100	85,036,600	897
2021	94,764,100	85,036,600	897
2022	94,764,100	85,036,600	897
2023	94,764,100	85,036,600	897
2024	94,764,100	85,036,600	897
2025	94,764,100	85,036,600	897
2026	94,764,100	85,036,600	897
2027	94,764,100	85,036,600	897
2028	94,764,100	85,036,600	897
2029	94,764,100	85,036,600	897
2030	94,764,100	85,036,600	897
2031	94,764,100	85,036,600	897
2032	94,764,100	85,036,600	897
2033	94,764,100	85,036,600	897
2034	94,764,100	85,036,600	897
2035	94,764,100	85,036,600	897
2036	94,764,100	85,036,600	897
2037	94,764,100	85,036,600	897
2038	94,764,100	85,036,600	897
2039	94,764,100	85,036,600	897
2040	94,764,100	85,036,600	897
2041	94,764,100	85,036,600	897
25-Year Cumulative Emissions	**2,364,660,500**	**2,122,117,500**	**—**

Sources: EPA 2012b, g, h.

Notes:

For 17 regional electric power producers in Arizona, Colorado, Navajo Nation, and New Mexico, Aggregated values rounded to nearest 100 metric tonnes (MT). 25-year cumulatives are for 2017-2041 (inclusive).

CO_2e = carbon dioxide equivalents

kg/MW-hr = kilograms per megawatt-hour (same as grams per kilowatt-hour)

MT = 1,000 kg or 2,204.6 lbs

MT/yr = metric tonnes per year

MW-hrs/yr = megawatt-hours per year

Table 4.2-15 Relative Annual Regional Contribution of FCPP GHG Emissions (Future 2014 to 2041)

Year	Percent of Regional Electrical Power Generation	Percent of Regional CO_2e Emissions
2014	13.7%	12.7%
2015	13.6%	12.6%
2016	13.5%	12.5%
2017	13.4%	12.4%
2018	13.3%	12.3%
2019	13.2%	12.2%
2020	13.1%	12.2%
2021	13.1%	12.2%
2022	13.1%	12.2%
2023	13.1%	12.2%
2024	13.1%	12.2%
2025	13.1%	12.2%
2026	13.1%	12.2%
2027	13.1%	12.2%
2028	13.1%	12.2%
2029	13.1%	12.2%
2030	13.1%	12.2%
2031	13.1%	12.2%
2032	13.1%	12.2%
2033	13.1%	12.2%
2034	13.1%	12.2%
2035	13.1%	12.2%
2036	13.1%	12.2%
2037	13.1%	12.2%
2038	13.1%	12.2%
2039	13.1%	12.2%
2040	13.1%	12.2%
2041	13.1%	12.2%

Sources: EPA 2012b, g, h.

Notes:

For 17 regional electric power producers in Arizona, Colorado, Navajo Nation, and New Mexico. 2014-41 estimated values.

CO_2e = carbon dioxide equivalents

Mobile Sources

Table 4.2-16 shows estimated GHG emissions from mining operations in the existing Navajo Mine SMCRA Permit Area and the proposed Pinabete SMCRA Permit Area and related activities, and Table 4.2-17 shows estimated GHG emissions from FCPP vehicles and mobile equipment. These mobile sources, although quantifiable, are relatively small compared to future power plant emissions, about 0.7 percent of the potential to emit, and well within EPA limits of precision of -2 to +5 percent for fossil fuel combustion (EPA 2012b).

Table 4.2-16 Estimated GHG Emissions from Navajo Mining Operations (Including Navajo Nation SMCRA Permit Area and Pinabete SMCRA Permit Area)

Mobile and Fugitive Sources	CO_2 MT/yr	CH_4 MT/yr	N_2O MT/yr	CO_2e MT/yr
Mine Extraction Operations and Loading	7,557	5.18	2.32	8,385
Coal Hauling Trucks to Stockpiles	2,010	0.11	0.05	2,028
Mining Support Vehicle Travel	2,134	0.11	0.04	2,150
Mine Fugitive Methane Emissions	—	2,747	—	57,687
Annual Totals	**11,701**	**2,752**	**2.42**	**70,251**
25-Year Cumulative Emissions	**292,531**	**68,810**	**60**	**1,756,263**

Source: OSMRE 2012a.

Notes:

CH_4 = methane
CO_2 = carbon dioxide
CO_2e = carbon dioxide equivalents
MT = metric tonnes (1,000 kg or 2,204.6 lbs)
N_2O = nitrous oxide

Table 4.2-17 Estimated GHG Emissions from FCPP Mobile Sources

Mobile Sources	CO_2 MT/yr	CH_4 MT/yr	N_2O MT/yr	CO_2e MT/yr
Power Plant Off-road Equipment	149	0.01	0.00	151
Power Plant On-road Vehicles	160	0.01	0.01	162
Annual Totals	309	0.01	0.01	313
25-Year Cumulative Emissions	7,727	0.34	0.27	7,817

Sources: APS 2012a; EPA 2012b, 2011a; SCAQMD 2008.

Notes:

CH_4 = methane
CO_2 = carbon dioxide
CO_2e = carbon dioxide equivalents
MT = metric tonnes (1,000 kg or 2,204.6 lbs)
N_2O = nitrous oxide

Future operation of FCPP and the Navajo Mine SMCRA Permit Area and Pinabete SMCRA Permit Area would emit GHGs and, therefore, contribute incrementally to climate change; however, these emissions would continue to comprise a negligible fraction – less than 1 percent – of the U.S. GHG inventory and the national electric power sector and about 12 percent of regional GHG emissions from electric power generation. This condition precludes meaningful quantification of the effects that FCPP mobile sources and mining operations may specifically have on climate change.

Fugitive GHG emissions from the Navajo Mine shown in Table 4.2-16 summarize data from the Area IV North Mine Plan Revision EA (OSMRE 2012a). GHG emissions are conservative, because they were based on a prior production rate of approximately 8.5 million tpy and the Proposed Action is for a reduced production rate of approximately 6 million tpy.

Emissions Monetization

The social cost of carbon (SCC) is a monetization of the effects associated with an incremental increase in carbon emissions. It is intended to quantify climate change-induced effects to net agricultural productivity, human health, property damage from increased flood risk, the value of ecosystem services and other factors. As described in Section 4.2.1.1, no Federal, tribal, or state rules or regulations currently limit or curtail emissions of GHGs from FCPP, Navajo Mine, or other sources in the state of New Mexico or Navajo Nation. Also, notwithstanding the GHG reporting rule, no Federal regulations currently limit or curtail GHG emissions of CO_2 and CH_4, and EPA cap-and-trade programs currently apply only to acid rain precursors SO_2 and NO_X (EPA 2012i). Therefore, at present no regulatory mechanism exists for assessing the significance of the GHG emissions. Qualitatively, the societal costs of GHG emissions and climate change generally refer to the financial, environmental, and societal costs resulting from sea level rise, diminishing water supplies, loss of plant and wildlife species, changes in ecosystems, increased wildfires, etc. These issues are addressed in detail in reports prepared by the IPCC referenced in the beginning of this chapter.

In Federal rulemaking proceedings, Executive Order 12866 requires that agencies "assess both the costs and the benefits of the intended regulation and, recognizing that some costs and benefits are difficult to quantify, propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs." In the context of including the SCC in cost-benefit analysis for rulemaking, a 12-member Interagency Working Group[4] was formed to assess the calculation of SCC. The Interagency Working Group released its initial Technical Support Document: *Social Cost of Carbon for Regulatory Impact Analysis* in February 2010, which was subsequently updated in May 2013.

According to the Interagency Working Group (2010): "[i]t is important to recognize that a number of key uncertainties remain, and that current SCC estimates should be treated as provisional and revisable since they will evolve with improved scientific and economic understanding. The interagency group also recognizes that the existing models are imperfect and incomplete. The National Academy of Science (2009) points out that there is tension between the goal of producing quantified estimates of the economic damages from an incremental ton of carbon and the limits of existing efforts to model these effects."

In particular, "[t]he choice of a discount rate, especially over long periods of time, raises highly contested and exceedingly difficult questions of science, economics, philosophy, and law. Although it is well understood that the discount rate has a large influence on the current value of future damages, there is no consensus about what rates to use in this context" (Interagency Working Group 2010).

Draft Guidance on climate change analysis was published by the CEQ in December 2014, and indicates that emissions monetization is not required in every project-level NEPA analysis:

[4] Council of Economic Advisers; Council on Environmental Quality; Department of Agriculture; Department of Commerce; Department of Energy; Department of Transportation; Environmental Protection Agency; National Economic Council; Office of Energy and Climate Change; Office of Management and Budget; Office of Science and Technology Policy; and Department of the Treasury.

"Monetizing costs and benefits is appropriate in some, but not all, cases and is not a new requirement. A monetary cost-benefit analysis need not and should not be used in weighing the merits and drawbacks of the alternatives when important qualitative considerations are being considered. If a cost-benefit analysis is relevant to the choice among different alternatives being considered, it must be incorporated by reference or appended to the statement as an aid in evaluating the environmental consequences. When an agency determines it is appropriate to monetize costs and benefits, then, although developed specifically for regulatory impact analyses, the Federal SCC, which multiple Federal agencies have developed and used to assess the costs and benefits of alternatives in rulemakings, offers a harmonized, interagency metric that can provide decision makers and the public with some context for meaningful NEPA review. When using the Federal SCC, the agency should disclose the fact that these estimates vary over time, are associated with different discount rates and risks, and are intended to be updated as scientific and economic understanding improves."

OSMRE has included emissions monetization of SCC in the Final EIS according to the Interagency Working Group methods to provide further context and enhance the discussion of climate change impacts in the NEPA analysis. Providing a SCC dollar amount did not, however, change the findings or the level of significance determined in the Draft EIS for climate change effects, which relied on a comprehensive qualitative analysis of SCC.

The full analytical methods and results of SCC quantification following the Interagency Working Group method are described in Technical Appendix A. The SCC is calculated for the each of the Action Alternatives. The GHG emissions (expressed as CO_2-equivalent emissions, CO_2e) are based on operating Units 4 and 5 of FCPP until 2041, and associated coal mining at the Navajo Mine. The SCC is also calculated for the No Action Alternative (shutting down FCPP and providing replacement generation from other available existing power plants in APS' portfolio and assumed new natural gas combined cycle facilities). Similarly, the four minority share co-owners of Units 4 and 5 would also need to replace lost base load generation with extra output from existing generating resources and possibly construct new combined cycle plants, either individually or collectively. The uncertainty in the results is expressed by using the range of discount rates presented in Interagency Working Group (2013), which provides a range in calculated SCC for each alternative.

As recommended by the Interagency Working Group, the 3 percent net present value discount rate represents the central value for this analysis and yields an amortized SCC (in 2014 dollars) of $59/MT CO_2e over the 25-year project life, with a range of $19/MT CO_2e to $179/MT CO_2e based on the range of Interagency Working Group-recommended discount rates.

Tables 4.2-18a and 4.2-18b compares the calculated SCC for the entire 25-year period for each EIS alternative in billions of dollars. The results are presented in both 2007 dollars (Table 4.2-18a) and 2014 dollars (Table 4.2-18b). The central value recommended by the Interagency Working Group, based on a 3 percent net present value, is provided in bold, and the values for the range in discount rates are presented to represent a range in values.

The difference between the Action Alternatives ($15.2 billion) and the No Action Alternative ($7.4 billion) represents a rough estimate of the marginal increase of SCC resulting from the Project, compared to No Action. The calculated cost of carbon under the No Action Alternative is approximately half that of the Action Alternatives.

Table 4.2-18a Cumulative Social Cost of Carbon – Discount Rate Comparison (2007$)

Alternatives	Cumulative Cost (Billion $) at each Discount Rate 5%	Cumulative Cost (Billion $) at each Discount Rate 3%	Cumulative Cost (Billion $) at each Discount Rate 2.5%	Cumulative Cost (Billion $) at each Discount Rate 95th 3%
A: Proposed Action	4.2	**13.3**	19.3	40.5
B: Navajo Mine Expansion Project	4.2	**13.3**	19.3	40.5
C: Alternative Pinabete Mine Plan	4.2	**13.3**	19.3	40.5
D: Alternative Ash Disposal Configuration	4.2	**13.3**	19.3	40.5
E: No Action	2.0	**6.4**	9.4	19.6

Sources: EPA 2014b, 2014c; APS 2014a; Interagency Working Group 2013; U.S. Bureau of Labor Statistics 2014.

Table 4.2-18b Cumulative Social Cost of Carbon – Discount Rate Comparison (2014$)

Alternatives	Cumulative Cost (Billion $) at each Discount Rate 5%	Cumulative Cost (Billion $) at each Discount Rate 3%	Cumulative Cost (Billion $) at each Discount Rate 2.5%	Cumulative Cost (Billion $) at each Discount Rate 95th 3%
A: Proposed Action	4.8	**15.2**	22.1	46.3
B: Navajo Mine Expansion Project	4.8	**15.2**	22.1	46.3
C: Alternative Pinabete Mine Plan	4.8	**15.2**	22.1	46.3
D: Alternative Ash Disposal Configuration	4.8	**15.2**	22.1	46.3
E: No Action	2.3	**7.4**	10.7	22.5

Sources: EPA 2014b, 2014c; APS 2014a; Interagency Working Group 2013; U.S. Bureau of Labor Statistics 2014.

As described above, the Proposed Action would comprise approximately 12 percent of GHG emissions resulting from electrical power generation in the region through 2041. Electrical power generation accounts for 34 percent of GHG emissions nationwide. Owing to compliance with EPA's FIP for BART, GHG emissions at FCPP would be reduced by 26 percent. Therefore, while the Proposed Action would contribute to the effects of climate change, its contribution relative to other sources would be minor in the short- and long-term (i.e., within EPA precision limits of -2 to +5 percent) since FCPP contributes about 0.6 percent of GHG emissions from electric power generation nationwide and about 0.2 percent of all GHG emissions nationwide, as shown in Table 4.2-5. The contribution would be approximately 26 percent less than historic emission levels owing to compliance with EPA's FIP for BART.

4.2.4.2 Alternative B – Navajo Mine Extension Project

Under Alternative B, Units 4 and 5 would operate as described for the Proposed Action. Although mining operations at the Navajo Mine would be conducted under a different mine plan, because Navajo Mine only contributes mobile source GHG emissions and these are so small in comparison to the GHG emissions from FCPP, impacts would be essentially the same as for the Proposed Action.

4.2.4.3 Alternative C – Alternative Pinabete Mine Plan

Under Alternative C, Units 4 and 5 would operate as described for the Proposed Action. Although mining operations at the Navajo Mine would be conducted under a different mine plan, because Navajo Mine only contributes mobile source GHG emissions and these are so small in comparison to the GHG emissions from FCPP, impacts would be essentially the same as for the Proposed Action.

4.2.4.4 Alternative D – Alternative Ash Disposal Area Configuration

Under Alternative D, mining operations at the Navajo Mine would be conducted as described under the Proposed Action. Units 4 and 5 would operate as described for the Proposed Action. The 10 percent reduction in surface area of the DFADAs would not impact GHG emissions because any mobile source emissions reduction would be small in comparison to the GHG emissions from FCPP. Impacts would be the same as described for the Proposed Action.

4.2.4.5 Alternative E – No Action Alternative

Under the No Action Alternative, the currently permitted supply of coal from Navajo Mine SMCRA Permit Area would run out in 2016, and mining operations and resultant emissions would permanently cease. Since the mine is the sole supplier of coal to FCPP, power plant operation and resultant emissions would also permanently cease in 2016. Navajo Mine would be closed and FCPP would be decommissioned. Table 4.2-19 shows estimated stationary and mobile source emissions under this scenario during 2014 and 2015. Beginning in 2016, mine closure would involve reclamation and conservation work, and power plant decommissioning would involve dismantling and salvage work; however, not all of these tasks are presently defined, therefore this analysis is beyond the scope of this study. Emissions resulting from equipment used to demolish and abandon FCPP (post 2016) would be minor in comparison to the action alternatives.

Table 4.2-19 Estimated GHG Emissions under the No Action Alternative – FCPP and Navajo Mine (Including the Navajo Mine SMCRA Permit Area and Pinabete SMCRA Permit Area)

Year	CO_2e Sources Stationary MT/yr	CO_2e Sources Mobile MT/yr	CO_2e Sources Combined MT/yr
2014	14,006,400	104,400	14,110,800
2015	14,006,400	104,400	14,110,800
2-Year Total	28,012,800	208,800	28,221,600

Sources: EPA 2012b, h.

Notes:

Values rounded to nearest 100 metric tonnes (MT)

CO_2e = carbon dioxide equivalents

Mobile = mining equipment and mine and power plant support vehicles

MT = 1,000 kg or 2,204.6 lbs

MT/yr = metric tonnes per year

Stationary = power plant emissions per 2005-11 baseline period (Units 1, 2, 3, 4, and 5)

4.2.5 Climate Change Mitigation Measures

EPA issued its FIP for BART at FCPP to control air emissions, which led to changes in the affected environment. This completed Federal Action is considered part of the environmental baseline to which the effects of continuing operations and the Proposed Actions are compared. As a result of the BART ruling, APS shut down Units 1, 2, and 3 on December 30, 2013, and will install SCR on the remaining Units 4 and 5. These steps result in a substantial reduction in the GHG emissions from FCPP. The expected timing of the reduction is from January 2014 to July 2018. As a result of implementing the steps required for BART compliance, GHG emissions from the FCPP would be reduced by 26 percent, and as a result of the GHG emission reductions from BART compliance, the percentage contribution of FCPP to regional GHG emissions will decrease from 16.7 percent to approximately 12 percent.

The Proposed Action, including the continuing operations of Navajo Mine, FCPP, and the transmission lines, by itself, would not result in a major contribution to adverse effects associated with climate change. Therefore, no additional mitigation is recommended. Draft CEQ guidance on climate change analysis (CEQ 2014) proposes that agencies should consider mitigation measures to reduce GHG emissions, subject to reasonable limits based on feasibility and practicality. This EIS considered alternatives to coal combustion in Chapter 3. The Navajo Mine proponents explored the feasibility of methane capture similar to the drilling processes used in commercial coalbed methane extraction. Methane in the Navajo Mine coal seams exists in a very low pressure environment, which would require the seams to be pressurized during the extraction process. Additionally no infrastructure, such as pipeline collection systems, is near enough to the mine to make collection and resale feasible. Therefore, due to low pressure in the coal seams and lack of infrastructure to bring captured methane to market, mine methane capture was determined to be infeasible.

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