

**Population and Energy Profiles and Costs
for the Kit Carson Electric Cooperative, Inc.
Service Area, Taos and Vicinity, New Mexico**



Prepared by

Renewable Taos, Inc.

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About This Report

This report documents current information on energy demands and nominal costs for most energy services provided within the Kit Carson Electric Cooperative, Inc. (KCEC) Service Area of New Mexico. The demand and cost information are calculated primarily for the years 2013 and 2014 unless otherwise noted. Most of the data are for the years 2009-2015 unless otherwise noted. The energy demands and costs are intended to provide a baseline for assessing alternative renewable energy strategies to offset or replace fossil fuel energy sources. The results also help reveal business opportunities for KCEC and others in terms of energy services that can be provided by local generation of renewable energy.

Disclaimers

This report is not intended to capture accurately all costs associated with energy use in the KCEC Service Area. It is intended for planning purposes using estimated and representative costs that might be changed or avoided as the region pursues renewable energy and other alternatives to fossil fuel consumption.

The information in this report is based on both direct and indirect measurements of population, energy use and costs. In many cases, these are estimated based on accepted models and calculation methods. This study prioritized population, energy and cost estimates based on data pertaining to actual activities in the Kit Carson Service Area of Taos, Rio Arriba, Colfax and Mora Counties, New Mexico. However, in some cases, prorating statewide and countywide data and national averages were the only options upon which to base calculations. This document explains sources, quality and usefulness of data throughout, and offers suggestions about improving the datasets.

This report uses nominal prices unless otherwise indicated. Nominal prices are the prices in U.S. dollars paid for a product or service at the time of the transaction. Nominal prices are those that have not been adjusted to remove the effect of changes in the purchasing power of the dollar, and they reflect buying power in the year in which the transaction occurred. These prices are averages for the specified time period.

This report is preliminary and subject to revision. The most current version is dated **February 2016** and supersedes all versions with an earlier date.

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http://quer-denken.tv/media/shutterstock_31616689.jpg



Local Energy and a Strong Economy

100% Clean Energy for our Community by 2030

Renewable Taos, Inc. is dedicated to promoting and facilitating a full transition to renewable energy and energy efficiency in Taos County and our surrounding region.

We advocate for local generation of renewable energy with an emphasis on local ownership. We build community partnerships to facilitate the transition to renewables, and propose and support projects. We recognize that energy efficiency is integral to the transition to renewable energy. We also work with other organizations to change the political climate in the state and country to facilitate the transition to renewable energy and energy efficiency.

<http://renewabletaos.org>

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Summary

This report provides data and interpretations on recent and current population and energy use data for the Kit Carson Electric Cooperative, Inc. (KCEC) Service Area.

The KCEC Service Area includes all of Taos County and small parts of Rio Arriba, Colfax and Mora Counties in North Central New Mexico.

Population for the KCEC Service Area in 2014 based on U.S. Census Bureau data for 2010 and 2014 was about 37,000 people living in an estimated 15,700 households.

Households throughout the KCEC Service Area use natural gas, wood, and propane as their primary sources of heating fuels. Small numbers of households use electricity or solar energy for primary heating. A very small minority use coal, coke, or other fuels, or no fuel. Approximately 6,087 households use natural gas as their primary heat source. About 2,622 households use propane, and 597 households use electricity for space heating. About 4,616 households use wood as their primary heat source.

For 2009-2015, all natural gas customers in the KCEC Service Area used an average of 1,120,000 cubic feet per year for an annual average cost of more than \$9,200,000 per year. Residential customers paid an average of \$6,020,000 per year for natural gas, or an average of about \$990 per household per year.

For 2013, all residential, commercial and other propane customers in the KCEC Service Area consumed an estimated 4,958,000 gallons. At a nominal cost of \$2.50 per gallon for the period, the total propane cost was in the range of \$12,400,000.

Average residential propane consumption was estimated at 2,975,000 to 3,471,000 gallons in 2013 for the KCEC Service Area. The total 2013 cost of propane for residential use in the KCEC Service Area was an estimated \$7,450,000 to \$8,680,000. For those using propane, the estimated cost in 2013 was between \$2,840 and \$3,310 per household.

Average annual electricity demand for all uses in the KCEC Service Area was 34.07 megawatts for 2011-2014. Average annual electricity consumption for the period was 298,453,200 kilowatt-hours (kWh). At an average retail consumer price of \$0.1275 per kWh, the average total electricity cost for all customers was \$38,053,000 per year.

Based upon residential electricity consumption of 500 kWh per month, the average household paid about \$765 per year for electricity during 2011-2015. Electricity costs for all uses amounted to about \$1,028 per capita for the period.

Electricity produced from both larger and smaller solar photovoltaic systems connected to the KCEC Service Area distribution grid was about 10,454,647 kWh, or 3.5 percent of the average electricity consumption for 2011-2014.

In 2014, there were an estimated 27,850 light-duty passenger vehicles for 15,700 housing units in the KCEC Service Area. Each of these vehicles travels an estimated 11,000 to 15,000 miles per year.

Estimated total fuel consumption for light-duty passenger vehicles associated with residences in the KCEC Service Area was 13,700,000 to 18,700,000 gallons for 2014. Depending upon the nominal price per gallon of gasoline during 2014, payments by residents were in the range of about \$34,000,000 to more than \$55,000,000.

Daily vehicle miles traveled (DVMT) in the KCEC Service Area were an estimated 866,000, or more than 316,000,000 miles for all classes of vehicles for 2014. This DVMT figure suggests consumption of about 11,000,000 gallons of gasoline and about 2,700,000 gallons of diesel fuel in 2014. The total cost of fuel consumed by all on-road vehicles traveling in the area is estimated at nearly \$37,000,000 for 2014.

Based on regional firewood prices for the winters of 2013-2015 in the range of \$150 to \$250 per cord, a mid-range cost for wood consumption for home heating is an estimated \$4,200,000 for the KCEC Service Area.

Energy customers within the KCEC Service Area paid an estimated annual total of about \$94,000,000 to \$115,000,000 for fossil fuel energy services, and about \$4,200,000 for wood for heating each year during 2013-2015. The spread in the numbers is largely related to short-term volatility in the nominal retail prices of gasoline and diesel fuel, and to a lesser extent, fluctuating prices of propane and natural gas. Assuming a 2014 population of 37,000, this amounts to a per capita expenditure of about \$2,650 to \$3,200. For the estimated 15,700 households in the area, the average annual expenditures for all energy services were about \$6,200 to \$7,600 per household in 2013-2014.

Summary of Estimated Costs of Fossil Fuel and Wood Energy Services,
 Kit Carson Electric Cooperative, Inc. Service Area, 2009 – 2015.

Fuel Type	Year(s)	Minimum or Average Cost (Dollars/Year)	Maximum or Average Cost (Dollars/Year)
Natural Gas	2009-2015	\$9,200,000	\$9,200,000
Propane	2009-2015	\$12,400,000	\$12,400,000
Electricity	2011-2014	\$38,053,000	\$38,053,000
Gasoline/Diesel	2014-2015	\$34,000,000	\$55,000,000
Subtotal, Fossil Fuels		\$93,653,000	\$114,653,000
Wood	2013-2015	\$4,200,000	\$4,200,000
Total		\$97,853,000	\$118,853,000

Notes: Wood costs are based on an estimated mid-range consumption of between 1 and 8 cords per year at current nominal local prices. Data on wood consumed for home heating currently are minimal for the region.

Introduction

The Kit Carson Electric Cooperative, Inc. (KCEC) Service Area in north central New Mexico includes all of Taos County and parts of bordering Rio Arriba, Colfax and Mora Counties (figure 1). About 37,000 people occupying about 15,700 households in 2014 in this area rely on energy services from a mix of coal-fired electricity, solar photovoltaic electricity, natural gas, propane, wood, gasoline, diesel fuel, and a few other minor energy sources.

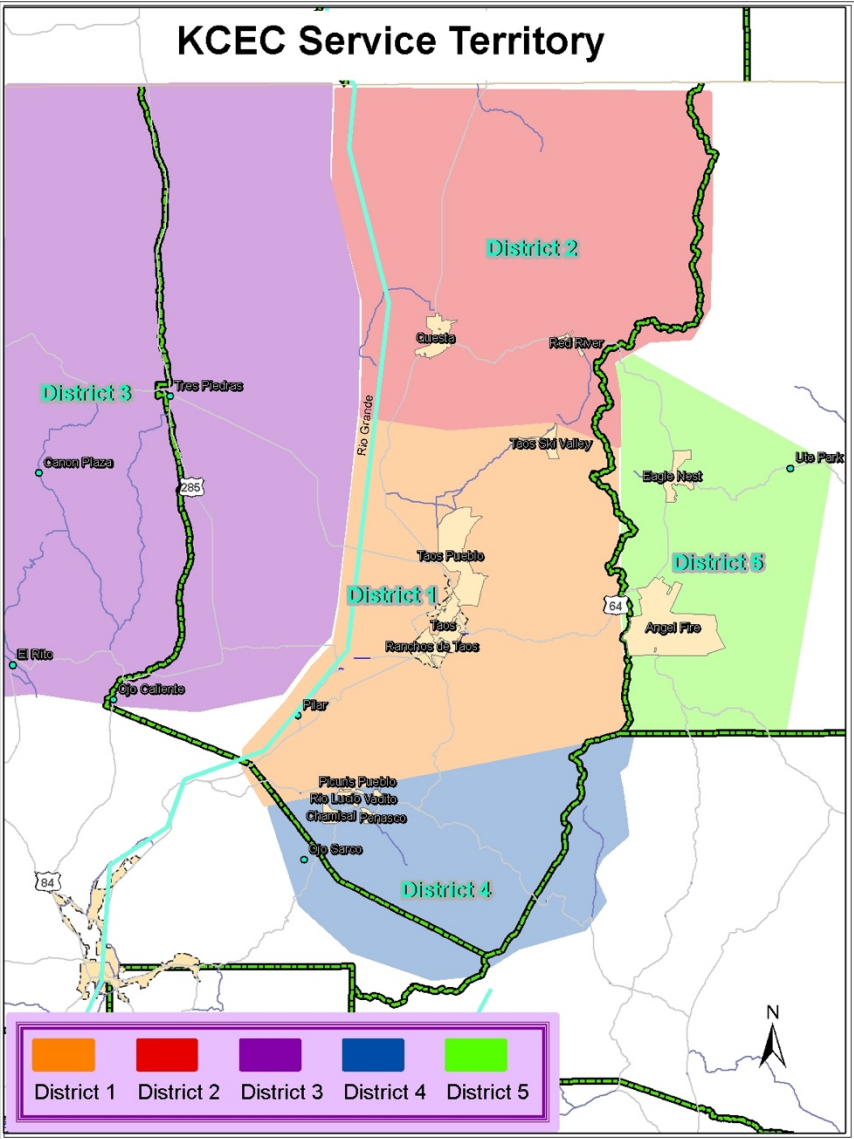


Figure 1. -- Map of Kit Carson Electric Cooperative, Inc. Service Area, Taos, Rio Arriba, Colfax and Mora Counties, New Mexico. Dark green lines are county boundaries. Source: <http://www.kitcarson.com/content/areas-served>

KCEC Service Area Population Estimates

Population numbers and projections are fundamental to understanding energy demands and costs. For this report, we use population information from the U.S. Census Bureau based on the 2010 national census and updated to 2014 (table 1).

Taos County, NM comprises most of the KCEC Service Area. For 2014, the U.S. Census reported a Taos County population of 33,084 (table 1). This population lived in 13,338 households, for an average of 2.43 people per household.

Communities in the KCEC Service Area in Rio Arriba County, NM include El Rito, Vallecitos, La Madera, Ojo Sarco, Los Piños, Las Tablas, La Petaca, San Miguel, and Cañon Plaza. Census data for 2010 estimate a population of 2,088 for El Rito, Vallecitos, La Madera and Ojo Sarco. There are no figures for the other communities for which we estimate a total of 250 people pending new information in the future. U.S. Census figures show little to no growth for 2010-2014. Thus, our estimate of population for communities in the KCEC Service Area in Rio Arriba County is 2,338. For Rio Arriba County as a whole, there are about 2.1 people per household. Prorating these numbers suggests about 1,100 households in the Rio Arriba section of the KCEC Service Area.

Communities in the KCEC Service Area in Colfax County, NM include Angel Fire, Eagle Nest, Ute Park, Idlewild, Lakeview Pines and Black Lake. Census data for 2010 estimate a population of 1,525 for Angel Fire, Eagle Nest and Ute Park. There are no figures for the other communities for which we estimate 200 people pending new information in the future. U.S. Census figures show little to no growth for 2010-2014. Thus, our estimate of population for communities in the KCEC Service Area in Colfax County is 1,725. For Colfax County as a whole, there are about 1.3 people per household. Prorating these numbers suggests about 1,300 households in the Colfax County section of the KCEC Service Area.

A small number of people also live on isolated ranches and other properties in western Colfax and Mora Counties, and eastern and southern Rio Arriba Counties. This population is not counted in our estimates, and is probably too small to substantially affect the calculations of energy demands and costs made in this report.

These population numbers suggest a total population for the KCEC Service Area of an estimated 37,000 people in 2014. This population lives in an estimated 15,700 households. For purposes of this report, we will use these numbers for energy use estimates, and make updates as new population data become available.

Table 1. – Population and Households Estimates,
Taos County, New Mexico, 2010-2014.

Population, 2014 estimate	33,084
Population, 2010 (April 1) estimates	32,940
Population, percent change - April 1, 2010 to July 1, 2014	0.4%
Households, 2009-2013	13,338
Persons per household, 2009-2013	2.43

Source: U.S. Census Bureau, State & County Quick Facts, Taos County, New Mexico: <http://quickfacts.census.gov/qfd/states/35/35055.html>

Fuels Used for Home Heating

Primary fuels used for home heating throughout the KCEC Service Area are natural gas, wood and propane (table 2). Small numbers of housing units use electricity or solar energy for primary home heating. Use of natural gas is confined to parts of Taos County served by New Mexico Gas Company. There are no natural gas services provided for communities within the KCEC Service Area outside Taos County.

Table 2. – Heating Fuel Used in Occupied Housing Units, Taos County, New Mexico, 2009-2013.

	Occupied Housing Units, Taos County, New Mexico	
	Heating Fuel Estimate	Percent of Housing Units
Utility gas (Natural Gas)	6,087	45.6
Bottled, tank, or LP gas (Propane)	2,244	16.7
Electricity	511	3.8
Fuel oil, kerosene, etc.	11	<0.1
Coal or coke	12	<0.1
Wood	3,925	29.4
Solar energy	391	2.9
Other fuel	130	0.9
No fuel used	27	0.2
Total	13,338	100.0

Source: U.S. Census Bureau, 2009-2013 5-Year American Community Survey
<http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF>

Based on the heating fuel estimates in table 2, and an estimated 15,700 households in the KCEC Service Area in 2014, approximately 39 percent or 6,087 households use natural gas as their primary heat source. A prorated 2,622 households use propane, and a prorated 597 households use electricity for space heating. A prorated 4,616 households use wood as their primary heat source.

Natural Gas

New Mexico Gas Company provides natural gas (utility gas) for Taos County by means of a pipeline that enters the county south of Pilar and continues into Taos, Arroyo Seco, Arroyo Hondo, Questa, and Red River where it terminates. Currently, a new natural gas pipeline is being built to connect the main pipeline in Arroyo Seco with the Taos Ski Valley. Again, natural gas services are not yet provided to KCEC Service Area communities in Colfax, Rio Arriba and Mora Counties.

Table 3 shows that all natural gas customers in the KCEC Service Area consumed an average of more than 1,120,000 thousand cubic feet per year (Mcf/yr) at an average cost of more than \$9,200,000 per year for 2009-2016. Residential customers paid an average of about \$6,020,000 per year for that period, or an average of about \$990 per household per year.

Table 3. – Natural Gas Consumption by End Use, Taos County, New Mexico, January 2009 – December 2014.

CLASS & YEAR	THERMS	1000 CUBIC FEET (Mcf)	PERCENT OF TOTAL	NOMINAL PRICE DOLLARS/Mcf	TOTAL COST
RESIDENTIAL 2009	6608504.43	621045	58.10	\$9.53	\$5,918,559.00
COMMERCIAL 2009	3137553.50	304343	28.50	\$7.52	\$2,288,659.00
INDUSTRIAL 2009		Est. 78745	Est. 7.37	\$5.41	\$426,010.45
GOVERNMENT 2009		Est. 64321	Est. 6.02	\$6.48	\$416,800.08
ANNUAL TOTAL 2009		Est. 1068454	100.00		\$9,050,028.53
RESIDENTIAL 2010	6767913.91	656488	57.08	\$9.63	\$6,321,979.44
COMMERCIAL 2010	3411584.31	330924	28.78	\$7.47	\$2,472,002.28
INDUSTRIAL 2010	933275.47	90528	7.87	\$6.17	\$558,557.76
GOVERNMENT 2010	742669.00	72039	6.26	\$6.18	\$445,201.02

ANNUAL TOTAL 2010	11855442.69	1149978	100.00		\$9,797,740.50
RESIDENTIAL 2011	6429766.24	623687	57.69	\$9.14	\$5,700,499.18
COMMERCIAL 2011	3315977.28	321650	29.75	\$6.98	\$2,245,117.00
INDUSTRIAL 2011	821547.81	79690	7.37	\$6.22	\$587,315.30
GOVERNMENT 2011	699622.65	67863	6.28	\$5.63	\$382,068.69
ANNUAL TOTAL 2011	11266913.97	1092891	100.00		\$8,915,000.17
RESIDENTIAL 2012	6297084.17	610817	56.47	\$8.69	\$5,307,999.73
COMMERCIAL 2012	3424529.20	332179	30.71	\$6.31	\$2,096,049.49
INDUSTRIAL 2012	768743.80	74568	6.89	\$4.96	\$369,857.28
GOVERNMENT 2012	661498.70	64165	5.93	\$4.73	\$303,500.45
ANNUAL TOTAL 2012	11151855.87	1081730	100.00		\$8,077,406.95
CLASS & YEAR	THERMS	1000 CUBIC FEET (Mcf)	PERCENT OF TOTAL	NOMINAL PRICE DOLLARS/Mcf	TOTAL COST
RESIDENTIAL 2013	7205915.33	698974	58.03	\$8.92	\$6,234,848.08
COMMERCIAL 2013	3562504.33	345563	28.69	\$6.77	\$2,339,461.51
INDUSTRIAL 2013	883862.65	85735	7.12	\$5.58	\$478,401.30
GOVERNMENT 2013	764620.18	74168	6.16	\$4.88	\$361,939.84
ANNUAL TOTAL 2013	12416902.49	1204440	100.00		\$9,414,650.73
RESIDENTIAL 2014	6738044.90	653590	58.06	\$10.13	\$6,620,866.70
COMMERCIAL 2014	3345457.86	324509	28.83	\$7.78	\$2,524,680.02
INDUSTRIAL 2014	884071.01	85755	7.62	\$6.38	\$547,116.90
GOVERNMENT 2014	637303.91	61818	5.49	\$5.72	\$353,598.96
ANNUAL TOTAL 2014	11604877.68	1125673	100.00		\$10,046,262.58

AVG ANNUAL COST 2009-14		1120527			\$9,216,848.24

Sources: **Therms** deliveries by **Class & Year** data from New Mexico Gas Company, written communication, September, 2015. One **Therm** equals about 0.097 thousand cubic feet (0.097 Mcf). One **Therm** is equivalent to approximately 29.3 kilowatt-hours (kWh) of electricity. U.S. Energy Administration natural gas price data are reported as nominal price in dollars per thousand cubic feet.

U.S Energy Information Administration, Natural Gas Prices, New Mexico, 1989-2015. http://www.eia.gov/dnav/ng/ng_pri_sum_dcu_SNM_m.htm

Notes: Prices for Government natural gas deliveries are estimated using USEIA **Citygate Prices** in the absence of more specific information. **Nominal price** is the price in U.S. dollars paid for a product or service at the time of the transaction. **Nominal prices** are those that have not been adjusted to remove the effect of changes in the purchasing power of the dollar; they reflect buying power in the year in which the transaction occurred. These prices are averages for the specified class and year.

Propane

Based on the estimates in table 2, a prorated 2,622 or about 17 percent of occupied housing units use propane as their primary source of energy for home heating in the KCEC Service Area.

The U.S. Energy Information Administration (USEIA) shows total consumption of propane (liquefied petroleum gas, LPG) for New Mexico as 26.8 trillion BTU for 2013. This equates to about 280,630,000 gallons of propane.

See: USEIA New Mexico State Profile and Energy Estimates, New Mexico Energy Consumption Estimates, 2013: <http://www.eia.gov/state/?sid=NM>

Based on a 2013 population for New Mexico of 2,085,538 in 2013, propane consumption was approximately 134 gallons per capita. These data should compare well with 2014 data that should be available from USEIA in 2016.

Prorating the New Mexico statewide per capita propane use to the KCEC Service Area population of 37,000 offers an estimate of about 4,958,000 gallons for all residential, commercial and other uses. At an average nominal price of \$2.50 per gallon for January 2009 through January 2016, the total estimated propane costs for the KCEC Service Area were in the range of \$12,400,000 for 2013.

Between 60-70 percent of propane sales in New Mexico are for residential uses, with the remainder going to commercial, industrial, retailer, internal combustion, and agricultural consumption (American Petroleum Institute, 2009).

At 60-70 percent for residential use, average propane consumption was estimated at 2,975,000 to 3,471,000 gallons in 2013 for the KCEC Service Area. This amounts to about 1,135 to 1,324 gallons per household per year for the 2,622 households using propane. At an average nominal price of \$2.50 per gallon for January 2009 through January 2016 (table 4), the estimated cost of propane is between \$2,840 and \$3,310 per household. The total annual cost of propane for residential use in the KCEC Service Area is an estimated \$7,450,000 and \$8,680,000 for 2013.

Table 4. – U.S. Propane Residential Price (Dollars per Gallon)
January 2009 – January 2016.

YEAR	JAN	FEB	MAR	OCT	NOV	DEC	AVG
2009	2.313	2.311	2.248	1.991	2.152	2.306	2.22
2010	2.562	2.602	2.556	2.270	2.389	2.516	2.48
2011	2.639	2.684	2.716	2.635	2.685	2.708	2.64
2012	2.710	2.706	2.708	2.205	2.241	2.249	2.71
2013	2.279	2.312	2.315	2.370	2.495	2.692	2.28
2014	3.165	3.692	3.182	2.392	2.404	2.385	3.17
2015	2.367	2.360	2.337	1.919	1.939	1.983	2.01
2016	2,014						
AVG							2.50

Source: USEIA, Petroleum & Other Liquids, U.S. Propane Residential Price, 02/07/2016.

http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=M_EPLLPA_PRS_NUS_DPG&f=M

Notes: Heating oil and propane prices are only collected by the USEIA during the heating season which extends from October through March.

Average Nominal Price, January 2009 – January 2016 = \$2.50 per gallon

Propane Prices and Demand (<http://www.propane101.com/propaneprices.htm>):

“Because propane is a commodity that is refined from other commodities and is traded on a worldwide market, propane prices can fluctuate greatly depending on unforeseen economic, political, climate and other factors...”

“One of the main factors influencing the price of propane is demand. Whether or not demand in your area is at a peak level is insignificant. What is significant is whether or not there is demand anywhere. For instance, if temperatures in the northeast United States are extremely cold, demand for propane goes up. Even if warm weather is prevalent around the rest of the country, there is still a higher demand for propane and propane is transported to the northeast where it is

needed from other parts of the country. Texas refines and processes a huge amount of propane from natural gas which is then shipped via pipeline or other mode of transportation to where it is needed. Even if the weather in Texas is unseasonably warm compared to the rest of the country, the price of propane in Texas will rise. To be very elementary in the explanation... it doesn't matter who is using the propane, it only matters that it is being used.”

Up-to-date data on propane prices, production, consumption, and other factors are available through the American Petroleum Institute, Basic Petroleum Data Book (published annually) and related publications. The API states, “As a trade organization representing all aspects of the U.S. oil and natural gas industry, API has access to information not found anywhere else.” API statisticians inspect this information and combine it with government data to provide a unique perspective on the energy sector.” API documents are available for purchase at prices ranging from several hundred to more than ten thousand dollars. For example, the report “API Sales of Natural Gas Liquids and Liquid Refinery Gases, 2014 Edition, December 1, 2014” has a current retail price of \$402. As of the date of this report, Renewable Taos, Inc. did not have the resources to purchase this and other propane data reports.

See: https://global.ihs.com/api_statistical_data.cfm?rid=API1

Electricity

The average annual electricity demand for the KCEC Service Area for 2011-2014 was 34.07 megawatts (MW), and the peak demand was 64.94 MW (Gusdorf, July 5, 2015, p.1). This means average annual electricity consumption for the period was 298,453,200 kilowatt-hours (kWh). According to Gusdorf (February 6, 2015, p. 5), the average consumer price was \$0.1275 per kWh. This is the price paid by all of KCEC’s customers including residential, commercial, industrial, government, and others. This price includes demand charges, fuel adjustments, and other fees, but does not include taxes. At \$0.1275 per kWh, the average electricity cost for all customers was therefore \$38,053,000 per year for 2011-2014.

Assuming an average consumption of 500 kWh per month by residential households, the 15,700 households in the KCEC Service Area each paid about \$765 per year for electricity in 2015. Electricity costs in 2015 for all uses amounted to about \$1,028 per capita based on 37,000 people in the KCEC Service Area.

Solar Photovoltaic Electricity

Electricity produced from solar photovoltaic systems connected to the KCEC Service Area distribution grid was 10,454,647 kWh in 2014 (table 5.) This amount is about 3.5 percent of the average consumption for 2011-2014. More than 68 percent of solar photovoltaic electricity was generated by the larger Blue Sky Energy, Amalia 1, and

UNM-Taos Arrays. About 20 percent of grid-tied solar photovoltaic electricity generation was produced by 242 residential and commercial installations as of the end of 2014.

Solar-electric power produced at residences and businesses that are not connected to the KCEC distribution grid is not included in this summary. Solar thermal heating systems used for space and hot water heating are not included in this summary. The survey data in table 2 (p. 9) indicate that about 3 percent of occupied households use some form of solar for primary heating. Basic systems would include active systems like solar thermal and solar photovoltaic, and passive solar in a variety of configurations.

Table 5. – Solar Photovoltaic Systems and Electricity Generated for KCEC Service Area Distribution Grid in 2014.

Facility/Array Name	Electricity Production Start Date	Nameplate Power Generation in Kilowatts (kW)	2014 Electricity Production in kilowatt-hours (kWh)	Percent of Total Solar Photovoltaic Electricity Production
Blue Sky Energy	8/01/2012	1,500	3,199,569	30.6
Amalia 1 (RCCLA)	05/21/2012	1,500	3,004,941	28.7
Residential & Commercial Arrays (242)	Ongoing	1,108	2,100,000	20.1
UNM-Taos	11/01/2009	500	953,304	9.1
Chevron Mining	02/01/2010	1,250	447,531	4.3
Taos Charter School (Community Solar)	08/27/2012	100	154,132	1.5
Eagle Nest Elementary School		100	152,872	1.5
Taos Eco Park	12/30/2011	79	119,065	1.1
Taos High School	12/30/2010	50	87,245	0.8
KCEC	01/14/2010	100	83,663	0.8
Peñasco Schools	12/30/2010	50	81,262	0.8
KTAOS Solar Radio	12/13/2010	43	71,063	0.7
Total 2014		6,380	10,454,647	100.0

Source: Kit Carson Electric Cooperative, Inc., FAQ: Solar Projects Fact Sheet, June 11, 2015.

Notes: Nameplate power generation refers to the maximum potential power production from the array or arrays under optimum solar radiation conditions.

Optimally sited arrays in the KCEC Service Area produce their nameplate output for about 6.1 hours per day as a year-around average.

KCEC reports 883,046 kWh were generated from 242 residential and commercial arrays in 2014. This amount is generation delivered to the local distribution grid from an estimated total generation of 2,100,000 kWh. The remainder, 1,216,954 kWh, is consumed at the sites of the residential and commercial arrays.

The Blue Sky Energy, Amalia 1, UNM-Taos, and Chevron Mining arrays are “Tracking Arrays.” These arrays have solar panels mounted on moveable axes, allowing the panels to face the sun directly throughout the day. These arrangements take maximum advantage of solar radiation from sunup to sundown, and increase the output of solar energy compared with that of fixed-mount panels that face in one direction (south) only.

RCCLA: Rio Costilla Cooperative Livestock Association, Costilla, NM

Gasoline and Diesel Transportation Fuels

Nationwide in the USA in 2015, there are about 135,000,000 households and 260,000,000 passenger vehicles, or slightly less than 2 vehicles per household. The numbers for Taos County (table 6) are similar, showing only slightly more than 2 vehicles per household. Using 15,700 households, and assuming the U.S. Census numbers apply to nearby Rio Arriba, Mora and Colfax Counties, there are an estimated 27,850 residential passenger vehicles in the KCEC Service Area in 2015.

Table 6. – Estimated Number of Vehicles Per Household, Taos County, NM, 2009-2013.

Taos County, New Mexico Vehicles Available	Occupied housing units
No vehicle available	6.4%
1 vehicle available	33.6%
2 vehicles available	35.9%
3 of more vehicles available	24.0%

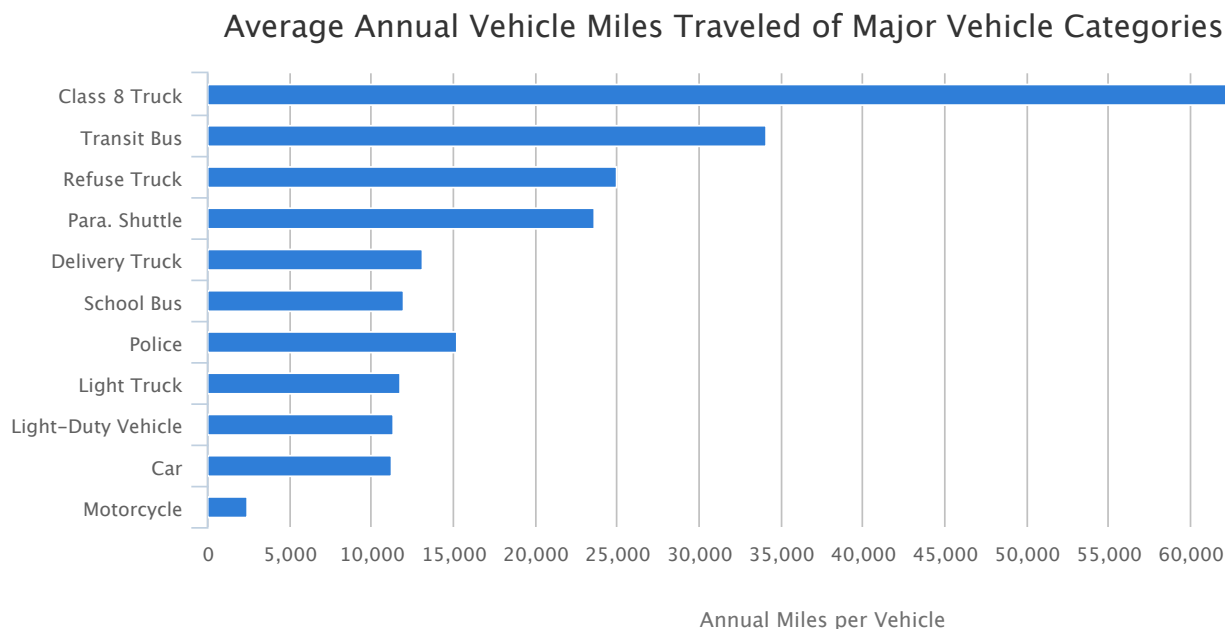
Source: U.S. Census Bureau, American Fact Finder 2015, Physical Housing Characteristics for Occupied Housing Units, 2009-2013 American Community Survey 5-Year Estimates, S2504.

<http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF>

USEIA, USEPA, U.S. Department of Energy, U.S. Federal Highway Administration, and other sources all show average vehicle miles traveled (VMT) for passenger cars and trucks to be about 11,000 miles per year for the USA (figure 2). VMT tends to be greater

in the Western USA, frequently approaching or exceeding 15,000 miles per year per passenger vehicle. For this report, we provide two figures for fuel consumption and costs based on VMT values of 11,000 and 15,000 miles per year.

Figure 2. -- Comparison of annual miles traveled (per vehicle) among vehicle types, June 2015.



*Last updated: June 2015
Printed on: September 12*

Sources: U.S. Department of Energy, Energy Efficiency and Renewable Energy, Alternative Fuels Data Center, Maps and Data, 2015.

<http://www.afdc.energy.gov/data/10309>

U.S. Federal Highway Administration, 2013, Table VM-1.

<http://www.fhwa.dot.gov/policyinformation/statistics/2013/>

American Public Transit Association's Public Transportation Fact Book, 2014, Tables 6, 7, and 20.

<http://www.apta.com/resources/statistics/Documents/FactBook/2014-APTA-Fact-Book.pdf>

USEIA figures for 2012-2014 with projections to 2040 show that the light-duty vehicle stock (passenger cars and trucks) for the USA increased from 21.5 mpg in 2012 to 22.3 mpg in 2014 (table 7). These numbers refer to all light-duty vehicles, new and used, traveling on USA roads during that period. Applying these fuel economy values to the estimated 27,850 residential light-duty vehicles in the KCEC Service Area, and estimating vehicle miles traveled at 11,000 and 15,000 miles per year, yields a total fuel consumption between 13,700,000 and 18,700,000 gallons estimated for 2014.

Table 7. – Energy Efficiency Indicators for Light-Duty Vehicles on USA Roads, in Miles Per Gallon (MPG), 2012-2040.

Year	2012	2013	2014	2015	2020	2025	2030	2035	2040
MPG	21.5	21.9	22.3	22.6	25.0	28.5	32.3	35.1	37.0

Source: U.S. Energy Information Administration, 2015, Annual Energy Review: Reference Case, Transportation Sector Key Indicators and Delivered Energy Consumption, Table A7. <http://www.eia.gov/forecasts/aeo/pdf/tbla7.pdf>

Notes: Miles per gallon are a combined “on-the-road” estimate for all cars and light trucks. Data in the reference table show estimated values for each year from 2012 through 2040 for many categories.

Estimated nominal gasoline prices at the pump for 2014-2015 ranged from less than \$2.50 per gallon to more than \$2.75 per gallon. USEIA data for the Rocky Mountain Region also show prices in this range for the same period. Gasoline prices are volatile, frequently changing rapidly over relatively short periods of days and weeks. At the time this report was prepared, the USEIA estimated gasoline prices in the region, including all taxes, to range from \$2.82 in late August 2015 to \$2.73 in the first week of September 2015.

Table 8 shows a range of estimated total annual costs of gasoline paid by residents of the KCEC Service Area based on the figures presented above. These costs range from less than \$34,000,000 to more than \$55,000,000 depending upon local gasoline prices during the period. Note how the costs may change significantly with small changes in the nominal price of gasoline. For example, a \$0.25 increase in gasoline prices, projected over the year, would mean an increase in total payments by passenger vehicle customers in the KCEC Service Area of about \$3,400,000 to more than \$4,600,000 depending on miles traveled during the year.

Table 8. – Estimated Range of Total Annual Payments for Gasoline, Residential Passenger Vehicles, KCEC Service Area, 2014.

Passenger Vehicle Miles Traveled 2014 (Miles Per Year)	Estimated Annual Gasoline Consumption by Passenger Vehicles, KCEC Service Area, (Gallons, 2014)	Nominal Price per Gallon (Dollars)	Estimated Total Annual Cost (Dollars)
11,000	13,738,000	\$2.50	\$34,345,000
15,000	18,733,200	\$2.50	\$46,830,000
11,000	13,738,000	\$2.75	\$37,780,000
15,000	18,733,200	\$2.75	\$51,520,000
11,000	13,738,000	\$3.00	\$41,210,000
15,000	18,733,200	\$3.00	\$56,200,000

For detailed updates on U.S. Regular gasoline prices by region in the USA, see: USEIA Petroleum & Other Liquids, Gasoline and Diesel Fuel Update: <http://www.eia.gov/petroleum/gasdiesel/>

The numbers in table 8 do not include non-residential passenger vehicles such as those driven by visitors in the area, and commercial, government, and other categories of passenger vehicles. The numbers also do not include larger vehicles such as tractors, commercial light trucks, heavy freight trucks, and other larger vehicles. The numbers do not indicate whether the gasoline was either purchased or used within the KCEC Service area or whether it was used elsewhere.

We focus on passenger cars and trucks because they dominate fuel consumption and vehicle miles traveled throughout the USA. Passenger vehicles are responsible for about 90 percent of the total vehicle miles traveled by all classes of highway vehicles in the USA (USEIA, 2015). Commercial light trucks and heavy freight trucks are responsible for most of the remaining 10 percent. There are no data for a detailed breakdown of vehicles by category for the KCEC Service Area. However, the New Mexico Department of Transportation routinely compiles daily vehicle miles traveled (DVMT) data for the state and all its cities and counties (table 9).

DVMT data (table 9) are useful for estimating gasoline and diesel fuels consumption for all vehicles traveling within and through a given county. For example, for 2009 and using DMVT data, about 80 percent of transportation fuel consumption by on-road vehicles in Taos County was calculated to be gasoline, and about 20% was diesel fuel for all vehicle classes (Brown, 2011, p. 124-126).

Table 9. – Daily Vehicle Miles Traveled (DVMT),
KCEC Service Area Counties, 2009-2015.

County	2009	2010	2011	2012	2013	2014	2015 (Projected)
Colfax	955,000	989,000	904,000	894,000	878,000	905,000	903,333
Mora	378,000	331,000	351,000	349,000	337,000	403,000	393,200
Rio Arriba	1,233,000	1,228,000	1,372,000	1,311,000	1,319,000	1,332,000	1,358,900
Taos	924,000	861,000	893,000	790,000	788,000	772,000	765,333

Source: New Mexico Department of Transportation, written communication, August 2015.

Converting 2014 DVMT into miles per year, and assuming an average fuel consumption of 22.3 mpg (table 7), total gasoline and diesel fuel consumption in the KCEC Service Area for 2014 is estimated at 14,170,000 gallons. Assuming 80 percent is gasoline consumption at a nominal price of \$2.75 per gallon yields a cost of about \$31,200,000. Assuming 20 percent is diesel consumption at a nominal price of \$2.50 per gallon yields a cost of about \$7,100,000. The combined cost of gasoline and diesel fuel consumed in 2014 is therefore about \$38,300,000.

The data in table 9 indicate trends such as a steady decline in DVMT in Taos County from 2009 to 2015. Projected DVMT for 2015 indicates a decline of about 20 percent from 2009. The reasons for this average daily travel decline for all vehicles are beyond the scope of this report. Planning for a transition to passenger vehicles powered by electricity will need to account for declining or increasing trends in DVMT, and practical limits for these trends.

Wood

Data from the (table 2, p. 11) show that an estimated 29.4 percent of households in Taos County use wood as a primary source of home heating. Assuming this percentage holds for KCEC Service Area households in Rio Arriba, Colfax and Mora Counties, an estimated 4,616 households use wood for home heating.

There are no data on quantities of wood burned for home heating. However, a local private company that is a major seller of firewood reports that wood prices for the winter of 2014-2015 are in the range of \$150 to \$250 per cord. Assuming that households burn quantities of wood in the range of one to eight cords per year, the estimated range of costs for wood for the KCEC Service Area is less than \$700,000 to more than \$9,000,000 (table 10). A mid-range cost for wood based on these numbers is an estimated \$4,200,000 for the 2014-2015 heating season.

Table 10. Wood Heating Fuel Consumption & Cost Estimates,
KCEC Service Area, New Mexico, 2014-2015.

Households Using Wood (table 2, p. 11)	Wood Consumption (Cords/Year)	Nominal Cost (Dollars/Cord)	Total Cost Estimate Range (Dollars)
4,616	1 to 8	\$150	\$692,000 - \$5,500,000
4,616	1 to 8	\$200	\$900,000 - \$7,200,000
4,616	1 to 8	\$250	\$1,154,000 - \$9,232,000
4,616	Mid-Range = 4.5	Mid-Range = \$200	Mid-Range = \$4,200,000

Wood is technically labeled a renewable resource on the basis that wood collected and burned for energy generation can be replaced by planting and growing more trees. This concept is based upon one-to-one replacement of wood volume burned with wood volume grown. However, the replacement process could take a substantial amount of time if there is not sufficient regrowth to offset the volume of wood burned. For rapid renewability, burning the wood of a century-old tree would require near-immediate replacement of that tree with an equivalent volume of growing wood. Otherwise, the replacement cycle to ensure renewability could take another century.

There are many other factors to consider in determining the full definition and costs of wood as a renewable resource, and these are beyond the scope of this document. For the future, the price of wood heating could be compared with other renewables alternatives such as solar thermal, solar electric, and geothermal heating.

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