Chapter 4

Geothermal Heating and Cooling: Applications for New Mexico's Industrial, Agricultural, Municipal, and Residential Sectors

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As is covered in other chapters of this report, geothermal has a long history in New Mexico, dating back centuries to Native American use of hot springs, all the way up to the state's first utility-scale geothermal electricity plant, the 15 megawatt Lightning Dock plant, in use today in the town of Animas in Hidalgo County.[1]

In part, the reason the plant is located in Animas is that in the 1960s and 1970s, research by the New Mexico Bureau of Geology and Mineral Resources,[2] prompted by rising oil prices, led to exploratory drilling and feasibility studies in various places in the state.[3] While those studies had limited success, Animas became home for a time to the nation's largest rose-growing greenhouse, powered by geothermal, and it is still home to the AmeriCulture geothermal tilapia farm.[4] The subsurface potential that prompted that early research holds true today: Directly using the Earth's heat for applications such as heating, cooling, agriculture, and industrial processes can significantly lower fuel costs and reduce emissions.

Nearly all of New Mexico has subsurface conditions capable of providing low to medium levels of heat (about 32°F–482°F, or 0°C–250°C), which could support a variety of direct use applications for industry, agriculture, and the built environment. The lower-temperature resources (32°F–212°F, or 0°C–100°C) are suitable for agricultural heating and low-temperature industrial processes. Medium-temperature resources (212°F–482°F, or 100°–250°C) can support uses in dairy processing, chemical production, and other industrial heating needs. Developing these geothermal resources in New Mexico offers a promising opportunity to tap clean, underground heat to meet growing thermal demands in these sectors.

This chapter explores the most promising locations and sectors in New Mexico for geothermal direct use by highlighting existing thermal energy usage. It also considers the potential for the state's industrial, agricultural, and building sectors to adopt geothermal heat. It examines the state's thermal energy demand, as well as how direct-use geothermal could help fulfill those requirements. Capitalizing on this potential can strengthen New Mexico's position as an energy leader, create new jobs for its workforce, and provide a sustainable and clean source of heat for local industries and agricultural enterprises.

To identify and prioritize the most promising geothermal direct-use applications in New Mexico, a twofold methodology was employed: (i) Assess thermal energy demand across various industries and temperature ranges statewide; and (2) cross-analyze with geothermal resource availability across the state. By mapping existing industrial and agricultural thermal demands by county and aligning them with geothermal temperature gradients at depth, we were able to identify regions where current heat demand could be fulfilled with geothermal.

GEOTHERMAL DIRECT USE IN INDUSTRY AND AGRICULTURE AROUND THE WORLD

Global case studies from regions with geothermal potential similar to New Mexico—including the state of Nevada, and regions in Iceland, Italy, and New Zealand—offer valuable lessons for scaling direct-use geothermal. Nevada's model for geothermal development includes a coordinated regulatory framework with streamlined permitting, effective state and federal agency collaboration, a focus on environmental and water management, and strong public–private partnerships. Taken together, these components create a supportive environment for geothermal investment.[5] In New Zealand, geothermal energy has been integrated into the country's traditional industrial processes.[6] This is a good example for New Mexico's mining and energy-intensive industries, as it illustrates how geothermal heat can support traditional sectors. Italy has leveraged geothermal resources for both electricity generation and direct-use applications such as district heating and greenhouses,[7] making it another relevant example for New Mexico, particularly in rural

2022 TOTAL ENERGY CONSUMPTION ESTIMATES BY END-USE SECTOR, RANKED BY STATE

Rank	Residential		Commercial		Industrial[a]		Transportation[b]		Total[a,b]	
	State	Trillion Btu	State	Trillion Btu	State	Trillion Btu	State	Trillion Btu	State	Trillion Btu
1	Texas	1,633.4	Texas	1,546.1	Texas	7,338.5	Texas	3,268.8	Texas	13,780.6
2	California	1,203.7	California	1,193.1	Louisiana	2,950.5	California	2,915.8	California	6,882.4
3	Florida	1,182.6	New York	969.8	California	1,539.3	Florida	1,738.8	Florida	4,325.0
4	New York	1,024.8	Florida	930.4	Pennsylvania	1,445.3	New York	1,128.1	Louisiana	4,246.0
5	Illinois	925.5	Illinois	743.9	Indiana	1,180.0	Illinois	892.8	Pennsylvania	3,736.9
34	Oregon	180.9	Oregon	134.0	**New Mexico**	248.0	Kansas	266.9	Nebraska	846.4
35	Nevada	157.3	Nevada	129.9	Oregon	233.2	**New Mexico**	230.0	West Virginia	835.5
36	West Virginia	153.8	Nebraska	122.7	Arizona	219.5	Connecticut	225.9	Alaska	724.1
37	Nebraska	143.0	West Virginia	107.0	Utah	201.0	Nebraska	199.7	Connecticut	707.6
38	Idaho	123.3	**New Mexico**	102.7	South Dakota	165.8	West Virginia	191.7	Nevada	706.1
39	**New Mexico**	107.9	North Dakota	90.0	Idaho	148.2	Alaska	189.0	**New Mexico**	687.6
40	New Hampshire	94.1	District of Columbia	82.6	Nevada	142.9	Idaho	169.9	North Dakota	670.6

[a]U.S. total includes -55.8 trillion Btu of net imports of coal coke that are not allocated to the states.

[b]U.S. total includes 25.5 trillion Btu of other bio fuels not allocated to the states.

Figure 4.1: 2022 Total energy consumption estimates by end-use sector, ranked by state. Source: U.S. Energy Information Administration. (2022). *Table C.11. Total energy consumption estimates by end-use sector, ranked by state, 2022*. State Energy Data System. https://www.eia.gov/state/seds/sep_sum/html/pdf/rank_use.pdf

and industrial areas. Iceland's emphasis on geothermal for local energy security,[8] with a focus on heating and industrial applications,[9] demonstrates geothermal's potential to reduce reliance on imported fuels. These examples highlight the importance of taking a diversified approach to geothermal development.

HEAT USE IN OIL AND GAS PRODUCTION

In New Mexico, total energy consumption figures are heavily influenced by natural gas production.[10] New Mexico remains a top 10 natural gas producer in the United States (3,160,057 million cubic feet produced in 2023);[11] the state exports much of its output to neighboring states such as Arizona and Texas. Two natural gas processes require a high amount of thermal energy: gas separators and gas dehydrators. Heat is often used to separate natural gas from other components such as liquids and impurities. In gas dehydration facilities, heat is used to remove water vapor from a natural gas stream. These processes typically occur where most of New Mexico's natural gas production takes place—in the Permian Basin in the southeastern part of the state and the San Juan Basin in the northwestern part.[12] Although most processes in petroleum refineries occur above 482°F (250°C), about 35% of the processes (e.g., separation of impurities, crude oil stabilization, water treatment, storage facilities, and surface equipment operations) use lower-temperature operations.[13]

HEAT USE IN MANUFACTURING, AGRICULTURE, AND THE BUILT ENVIRONMENT

In 2018, fuels accounted for about 68% of manufacturing energy consumption nationally, with feedstocks constituting the rest.[14] According to the Manufacturing Energy Consumption Survey (MECS) for the West Census Region, fuel for manufacturing in the West consumed 1,234 TBtu of energy in 2018.[15] Of that thermal energy, conventional boiler use and direct-use process heating accounted for 44.7%, or 552 TBtu (see **Figure 4.2**).[16] Adding combined heat and power (CHP) and/or co-generation process increases the amount to 732 TBtu (59.3%); however, it is challenging to separate out how much of CHP is attributed to heat for processes as opposed to generating electricity.

Unfortunately, MECS data is not released on a state-by-state basis, so we don't have exact figures for New Mexico. In 2018, however, the National Renewable Energy Laboratory (NREL) derived New Mexico-specific manufacturing fuel consumption estimates by combining the 2014 MECS with Census Bureau data. The data set provides thermal energy use estimates, broken down by industry and end use (e.g., boilers, CHP and co-generation, and process heating).[17]

MANUFACTURING END USES OF FUEL CONSUMPTION IN WESTERN STATES

End Use	Electricity	Fuel Oil	Diesel Fuel	Gas	Natural Gasoline	Coke and Breeze	Total	Percentage of Total
Total Fuel Consumption	406	4	18	699	17	90	1234	100.00%
Indirect Uses Boiler Fuel	6	1	2	266	2	33	310	25.12%
Conventional Boiler Use	6	*	1	118	1	4	130	10.53%
CHP and/or Cogeneration Process	–	1	1	149	*	29	180	14.59%
Direct Uses-Total Process	311	3	7	374	12	57	764	61.91%
Process Heating	29	3	2	343	10	35	422	34.20%

Figure 4.2: Selected manufacturing end uses of fuel consumption in 2018 for the West Census region in TBtu. Source: U.S. Energy Information Administration. (2021). *2018 MECS survey data*. https://www.eia.gov/consumption/manufacturing/data/2018/?src=%E2%80%B9%20Consumption%20%20%20%20%20%20Manufacturing%20Energy%20Consumption%20Survey%20(MECS)-f1#r5.

** = Estimate less than 0.5*

— = estimation is not applicable

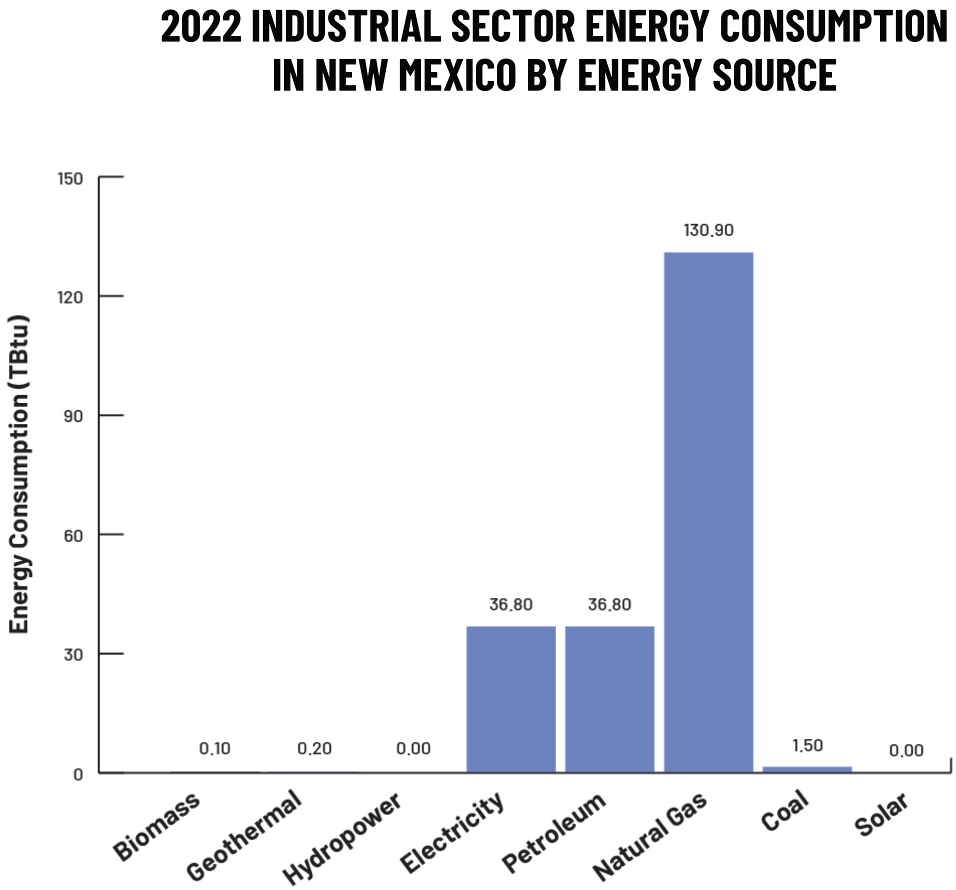

Figure 4.3: New Mexico industrial energy consumption by source. Source: U.S. Department of Energy. (2019). *GeoVision: Harnessing the heat beneath our feet.* https://www.energy.gov/sites/prod/files/2019/06/f63/GeoVision-full-report-opt.pdf

Agriculture is a major user of heat. The U.S. Department of Agriculture (USDA) estimates that across the United States, the agricultural sector used 1,872 TBtu of energy, representing approximately 1.9% of the total U.S. primary energy consumption in 2016.[18] Between 2012 and 2015, the sector became more energy-intensive, with energy consumption increasing by more than 10%, compared with 6% growth in agricultural output.

As shown in **Figure 4.1** and corresponding data, New Mexico represents 0.73% of the total U.S. energy consumption.[19] Assuming this percentage holds steady, and applying it to USDA's national estimate, we could expect New Mexico's agricultural sector to consume 13.67 TBtu annually.

In 2022, New Mexico's residential and commercial building sectors consumed 107.9[20] and 102.7[21] TBtu, respectively. Although data on heating supplied by natural gas for the commercial sector is unavailable, roughly 76% of New Mexico's housing units are heated by natural gas,[22] which cost New Mexico's residents approximately $429 million in 2023.[23]

Currently, a significant portion of the state's thermal demand is generated by burning fossil fuels. **Figure 4.3** offers a detailed breakdown of New Mexico's 2022 industrial sector consumption by energy source.

HEAT USE AND EMISSIONS IN THE LAND OF ENCHANTMENT

According to data from New Mexico's Environment Department, the state emitted 67.5 million metric tons of carbon dioxide equivalent in 2021 not including methane emissions.[24] About 29% of those emissions came from the oil, gas, and mining sector, and 23% came from industrial uses, including agriculture; the residential and commercial sectors accounted for 6%.[25] Many of those emissions become concentrated, and have the most impact, in the regions and counties where the activities occur.

MANUFACTURING HEATING FUEL CONSUMPTION IN NEW MEXICO BY TEMPERATURE, 2014

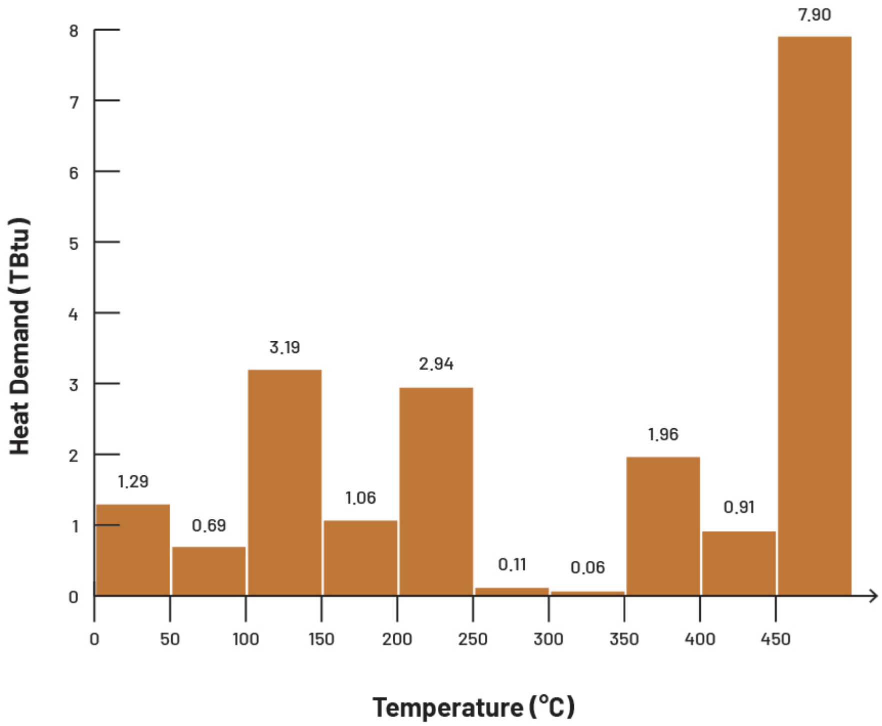

Figure 4.4: New Mexico manufacturing heating fuel consumption by temperature, 2014. Source: McMillan, C. (2019). *2018 industrial energy data book.* National Renewable Energy Laboratory. https://data.nrel.

By using geothermal energy for direct use, New Mexico could reduce a substantial portion of those agriculture and industrial-use emissions and reduce emissions from heating and cooling of the built environment. And it could be used in the low end of the oil and gas sector's thermal operations to meet about 10% of demand.[26]

MANUFACTURING PROCESS HEATING BY TEMPERATURE RANGE AND COUNTY

Despite some early direct-use successes (e.g., geothermally heated greenhouses and aquaculture), much of New Mexico's geothermal potential remains underused in the industrial sector. Geothermal energy is rarely used for manufacturing processes that require heating or cooling. Expanding geothermal use in these applications could unlock significant untapped potential in the state.

An important note: Unlike gas or electricity, which can be easily dispersed through pipelines or power lines, heat is harder to move across long distances. As a result, demand for any direct-use geothermal heat project for the sectors would need to be undertaken relatively close to the heat resource, so it is key to look to the locations where the demand and the subsurface heat overlap. Opportunely, energy demand between 32°F and 482°F (0°C to 249°C) in New Mexico is concentrated in specific regions.

Although the available NREL data on industrial thermal demand is more than a decade old, it provides the most comprehensive breakdown of New Mexico's process-heat consumption. New Mexico's total industrial energy demand has stayed relatively stable in recent years, so the 2014 data set provides a valuable reference point. The NREL data set includes some information on temperatures needed for processes, but a more detailed breakdown of specific process temperature requirements could enhance the analysis. To that end, we have incorporated granular information from a 1985 U.S. Energy Information Administration study that surveyed 108 different manufacturing processes

COUNTIES WITH HIGHEST MANUFACTURING SECTOR HEATING DEMAND

County	Demand (TBtu) 32°F-302°F	County	Demand (TBtu) 32°F-482°F
Eddy	**1.36**	Eddy	**2.50**
McKinley	**1.04**	Bernalillo	**1.97**
Bernalillo	**0.72**	McKinley	**1.75**
Lea	**0.58**	Lea	**1.12**
Chaves	**0.41**	Chaves	**0.42**
Doña Ana	**0.36**	Doña Ana	**0.39**
Roosevelt	**0.34**	Roosevelt	**0.37**
Curry	**0.17**	Santa Fe	**0.20**
Santa Fe	**0.07**	Curry	**0.17**
Valencia	**0.02**	San Juan	**0.07**

Figure 4.5: New Mexico counties with highest manufacturing sector heating demand (32°F-302°F (0°C -150°C) and 32°F-482°F (0°C-250°C) in TBtu. Source: Authors' analysis.

PROCESS HEATING DEMAND (32°F TO 302°F) FOR SELECTED INDUSTRIES BY SELECTED COUNTIES

	Dairy product mfg.	Petroleum and coal products mfg.	Pulp, paper, and paperboard mills	Phosphatic and fertilizer mfg.	Fruit and vegetable preserving and specialty food mfg.	Basic chemical Mfg.
Eddy	0.00	0.42	0.00	0.62	0.01	0.11
McKinley	0.00	0.29	0.75	0.00	0.00	0.00
Bernalillo	0.04	0.00	0.00	0.00	0.27	0.00
Lea	0.00	0.19	0.00	0.00	0.05	0.12
Chaves	0.41	0.00	0.00	0.00	0.00	0.00
Doña Ana	0.05	0.00	0.00	0.00	0.14	0.00
Roosevelt	0.34	0.00	0.00	0.00	0.00	0.00
Curry	0.17	0.00	0.00	0.00	0.00	0.00
Santa Fe	0.00	0.04	0.00	0.00	0.00	0.00
Valencia	0.00	0.00	0.00	0.00	0.00	0.00

Figure 4.6: Process heating demand (32°F-302°F, 0°C-150°C) for selected industries by selected counties (TBtu). Source: Authors' analysis.

HEATING DEMAND FOR NEW MEXICO INDUSTRIES IN SELECTED TEMPERATURE RANGES

Industry	32°F-120°F	122°F-210°F	210°F-302°F	302°F-392°F	392°F-482°F
Petroleum refineries	0.93				2.34
Other basic inorganic chemical manufacturing	0.23	0.01	0.40	0.10	0.03
Breakfast cereal manufacturing	0.03	0.01	0.25	0.24	
Frozen fruit, juice, and vegetable manufacturing	0.03	0.01			
Dried and dehydrated food manufacturing	0.01				
Phosphatic fertilizer manufacturing		0.62			
Aircraft manufacturing		0.01			
Pulp, paper, and paperboard mills			0.75		
Dairy product manufacturing: Cheese manufacturing			0.61		
Dairy product manufacturing: Dry, condensed, and evaporated dairy product manufacturing			0.34		
Lime and gypsum product manufacturing				0.30	0.47
Asphalt paving mixture and block manufacturing				0.15	
Cement manufacturing				0.15	
Ethyl alcohol manufacturing					0.03
Surgical and medical instrument manufacturing					0.01
Total	1.23	0.66	2.35	0.94	2.88

Figure 4.7: Heating demand in TBtu for New Mexico industries in selected temperature ranges. Source: Authors' analysis of NREL data set combined with process temperature data.

(including various industrial cooling needs).[27] By combining the NREL data with these detailed temperature requirements, we have a clearer picture for New Mexico.

Reviewing the data across New Mexico's industrial landscape reveals distinct patterns. (See **Figures 4.4** to **4.7**.) The highest demand for thermal energy occurs at temperatures above 840°F (450°C), totaling about 7.9 TBtu annually.[28] Current geothermal technologies don't allow heat to be cost-effectively harnessed for direct use at this extreme end of the temperature range.

However, nearly half of New Mexico's manufacturing heat demand (about 9.17 TBtu) is below 482°F (250°C). That is something geothermal can accommodate.[29] (See **Figures 4.4** to **4.7.**)

The following sections discuss industries with thermal demand in several temperature ranges.

DISTRIBUTION OF INDUSTRIAL DEMAND FROM 32°F TO 120°F BY COUNTY

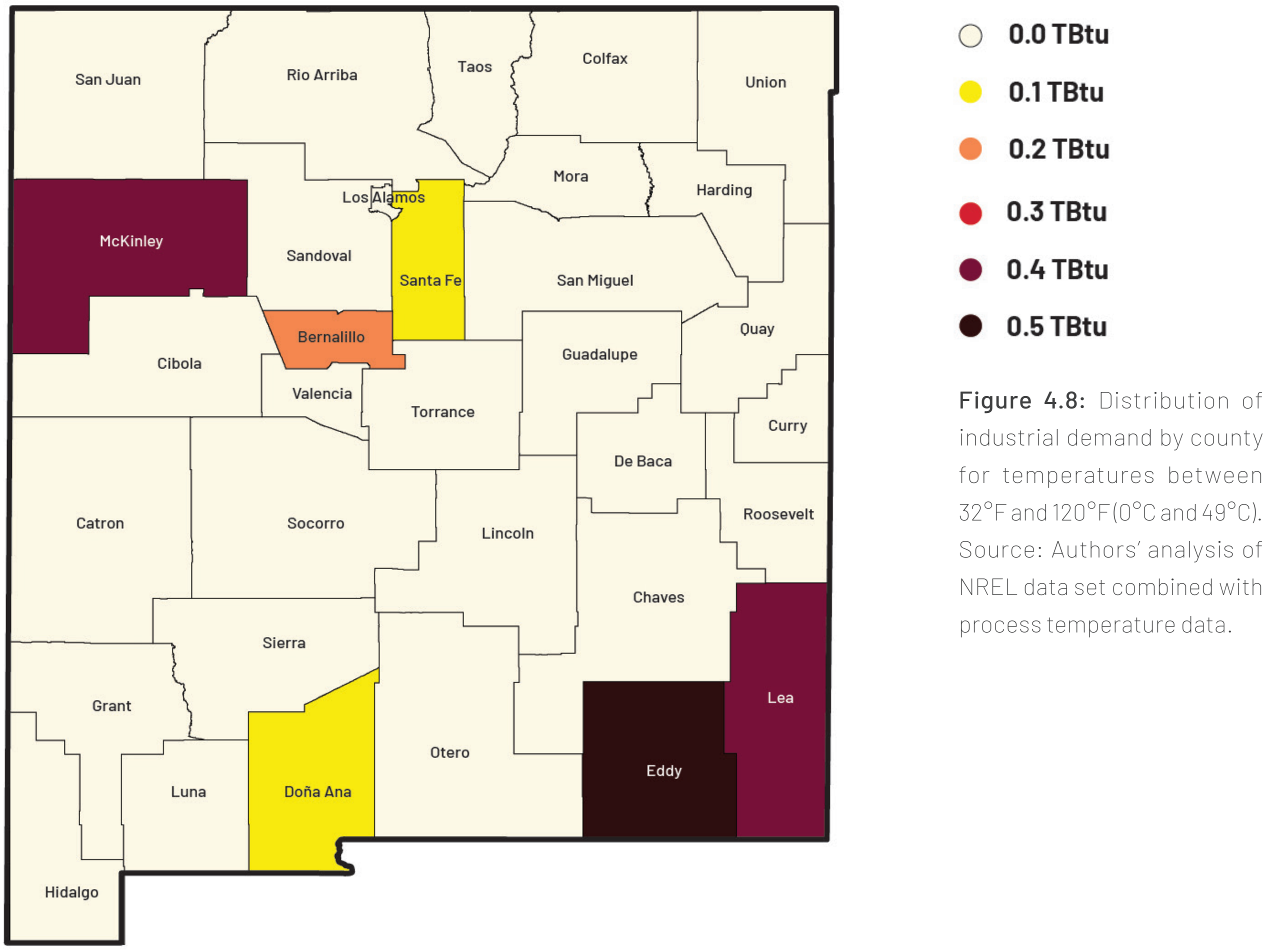

Figure 4.8: Distribution of industrial demand by county for temperatures between 32°F and 120°F (0°C and 49°C). Source: Authors' analysis of NREL data set combined with process temperature data.

NEW MEXICO'S THERMAL ENERGY DEMAND: 32°F–120°F (0°C–49°C)

From the analysis of thermal demand, Eddy and Lea Counties—where much of New Mexico's oil and gas extraction occurs—have the state's largest demand in the range of 32°F to 120°F (0°C to 49°C).[30] Although the geothermal resource in these counties is minimal compared with the rest of New Mexico, geothermal still offers enough potential applications to meet the thermal load in these counties, making them ideal candidates for low geothermal heat direct-use applications. Processes operating between 0°C and 49°C (32°F–120°F)[31] in the oil and gas industry—including separating impurities, crude oil stabilization, water treatment, storage facilities, and surface equipment operations—produce 10% of the emissions from petroleum refining. All of these processes could incorporate direct-use geothermal.

McKinley County also has a high demand for heat below 120°F (49°C). The bulk of this energy is used for water treatment associated with produced waters from oil and gas operations[32] and climate control for freight at the inland port in Gallup.[33] House Bill 361, which passed in 2025, allows for abandoned and orphaned oil and gas wells to be repurposed for geothermal. Given the high overlap of wells in these counties and their need for heat, it is likely that some of these wells, if converted to geothermal, could provide much of this heat.

The remaining thermal demand in the 32°F–120°F (0°C–49°C) range is centered in the counties of Bernalillo,

DISTRIBUTION OF INDUSTRIAL DEMAND FROM 122°F TO 210°F BY COUNTY

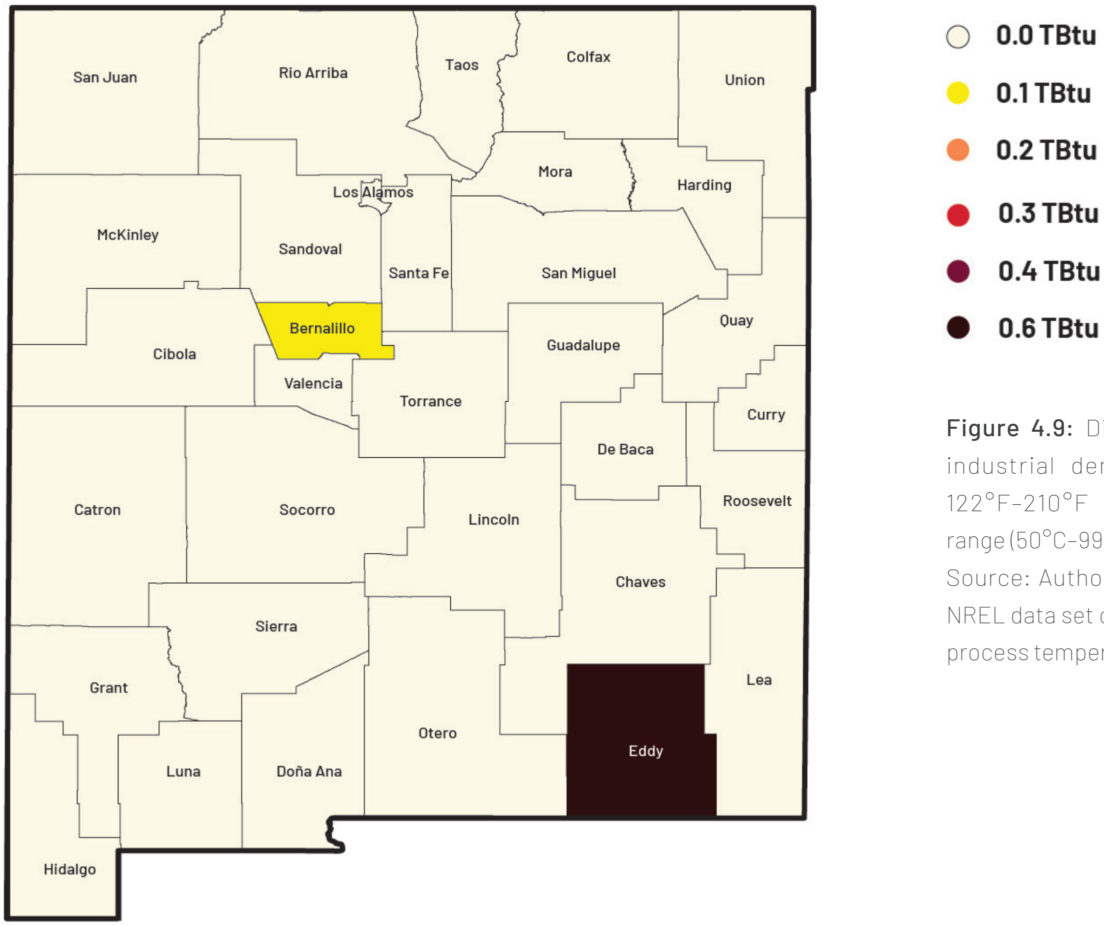

Figure 4.9: Distribution of industrial demand in the 122°F–210°F temperature range (50°C–99°C), by county. Source: Authors' analysis of NREL data set combined with process temperature data.

Doña Ana, and Santa Fe. The industries with demand in this range primarily manufacture inorganic chemicals, frozen goods (e.g., fruit, juice, vegetables), cereals, and dehydrated food products (a process done via geothermal heat in many other regions in the world).[34]

NEW MEXICO'S THERMAL ENERGY DEMAND: 122°F–210°F (50°C–99°C)

Of the 0.69 TBtu needed in the 122°F–210°F (50°C–99°C) temperature range, all but 0.04 TBtu are for phosphatic fertilizer manufacturing[35] in Eddy County. Although it is technically feasible for geothermal direct-use to meet this demand, this approach wouldn't be economical because there aren't enough subsurface resources in Eddy (or Lea) counties. As technology improves and drilling costs continue to decrease over the next 5 to 10 years, these industries should revisit the option of geothermal direct use.

The remaining TBtu comes from the heating used to manufacture inorganic chemicals, frozen goods (e.g., fruit, juice, vegetables), cereals, and select aircraft equipment in Bernalillo.[36] Bernalillo's strong subsurface potential means these industries can tap into this geothermal heat now.

NEW MEXICO'S THERMAL ENERGY DEMAND: 212°F–302°F (100°C–149°C)

Thermal demand in the 212°F to 302°F (100°C to 149°C) range is more widespread across New Mexico. The total energy demand in this heat range is 3.19 TBtu,[37] and in many places, that demand is in close proximity to the necessary heat resources for geothermal development.

DISTRIBUTION OF INDUSTRIAL DEMAND FROM 212°F TO 302°F BY COUNTY

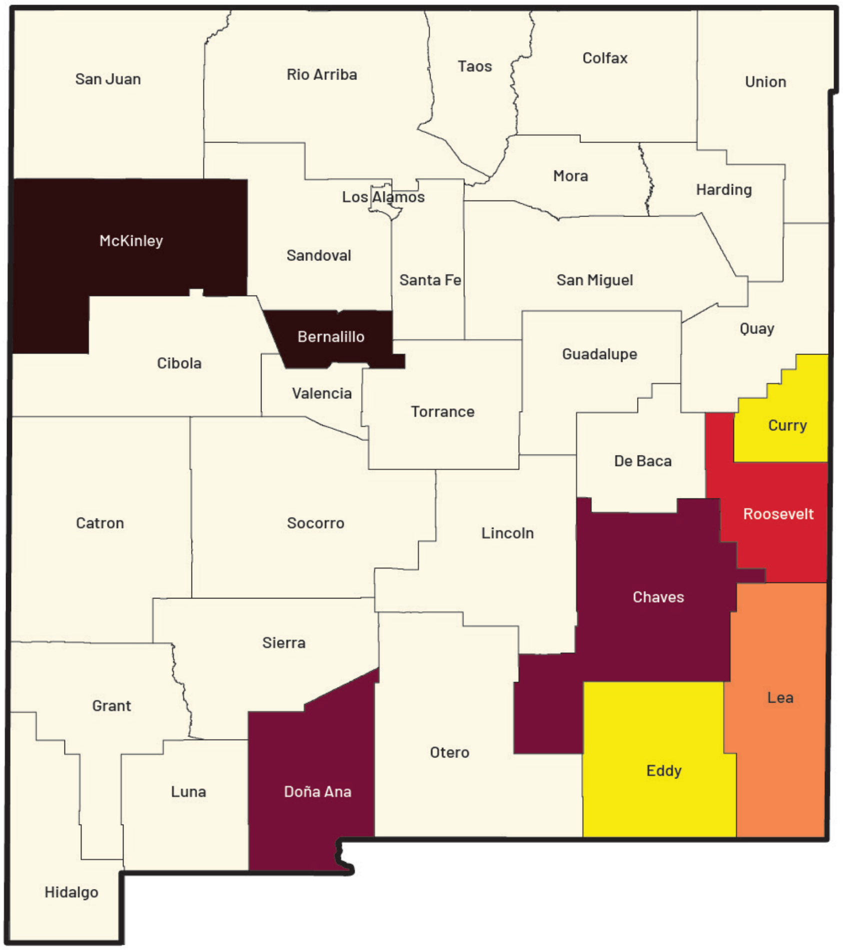

Figure 4.10: Distribution of industrial demand in the 212°F-302°F temperature range (100°C-149°C), by county. Source: Authors' analysis.

As mentioned, geothermal doesn't have a lot of potential yet for meeting the higher-temperature thermal demand in Eddy and Lea counties, but that story changes in the southeastern counties of Chaves, Curry, and Roosevelt. Almost all of New Mexico's process heating demand for dairy product manufacturing is found in these three counties (except for small operations in Bernalillo and Doña Ana). Dairy production in Chaves County needs the most heat, at 0.41 TBtu, followed by Roosevelt (0.34 TBtu) and Curry (0.17 TBtu). **Figure 4.10** shows the full distribution in this temperature range by county.

Geothermal heat is used in dairy product manufacturing throughout the world. The temperatures available in the subsurface of areas in which most of the state's dairy manufacturing takes place means that these dairies should be considered low-hanging fruit in New Mexico.

Chaves County is home to one of the world's largest mozzarella cheese factories, operatred by Leprino foods, which processing more than 6 million pounds of dairy each day.[38] Leprino launched its first climate action strategic planning initiative in 2021 to minimize its environmental footprint.[39] It isn't clear whether a transition to geothermal was part of that initiative, but considering that Leprino has engaged in climate impact conversations in the past, it would be wise to explore the use of geothermal heat with the company. Similar opportunities could be looked into for Southwest Cheese LLC in Curry County, as the company processes nearly 4 billion pounds of raw milk each year, making it one of the largest cheese processing plants in the world.[40] In Roosevelt County, another area with sufficient subsurface heat, both the Dairy Farmers of America and Carter's Milk Factory have operations in the city of Portales.

DISTRIBUTION OF INDUSTRIAL DEMAND FROM 302°F TO 480°F BY COUNTY

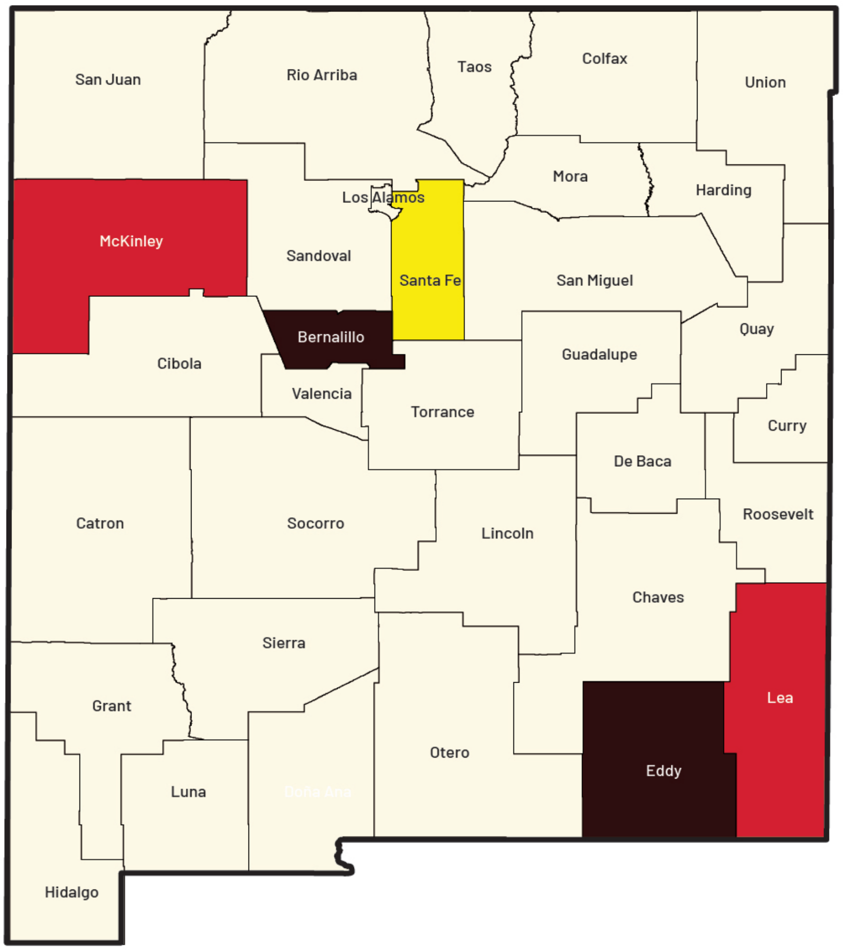

Figure 4.11: Distribution of industrial demand in the 302°F-480°F temperature range (150°C-249°C), by county. Source: Authors' analysis..

McKinley County is home to all of New Mexico's pulp, paper and paperboard mills, which account for 0.75 TBtu in the 212°F-300°F (100°C-149°C) range.[41] Pulp and paper manufacturing is another industry with global examples of geothermal's ability to provide heat.[42,43] The major player in New Mexico is the McKinley Paper Company in Prewitt, New Mexico. Until 2019, the mill's steam was supplied by the Escalante Generating Station. Since then, officials have considered the development of a hydrogen production facility, but it faces considerable challenges.[44] Just as it has been used with other pulp and paper facilities across the globe, geothermal direct use could be an immediate option to replace the thermal demand for the McKinley Paper Company.

Bernalillo County's high thermal demand in this temperature range comes from the manufacturing of inorganic chemicals (0.4 TBtu) and cereal (0.25 TBtu), both industries for which geothermal has a track record of supplying heat.[45,46] With Bernalillo's subsurface potential, the companies based there could create quick and economical decarbonization pathways by developing geothermal direct use for their thermal demands.

NEW MEXICO'S THERMAL ENERGY DEMAND: 302°F–480°F (150°C–249°C)

Thermal demand in the 302°F-480°F (150°C-249°C) range accounts for 4 TBtu of New Mexico's manufacturing sector. Petroleum refineries, which are responsible for a good portion of New Mexico's demand in this range, are primarily concentrated in Eddy and Lea counties. As mentioned earlier, the heat needed for these processes is located too deep to currently provide economic geothermal heat. However, given the substantial heat demand and known geothermal gradients, McKinney (0.00075 TBTu), Bernalillo (0.00125 TBTu) and Santa Fe (0.00025 TBtu) counties are prime candidates for direct-use geothermal in processing operations such as crude oil distillation, cement production, and heavy manufacturing (see **Figure 4.11** for the distribution by county). **Figure 4.7** shows the major industries with heat demand in this range.

HEATING AND COOLING DEMAND FOR RESIDENTIAL AND COMMERCIAL BUILDINGS

The state of New Mexico is forecasting that 5.7% (3.9 MMTCO2e) of its 2025 GHG emissions will come from the commercial and residential sectors.[47] This amount is largely due to the energy required to keep buildings at comfortable indoor temperatures, typically between 68°F and 73°F (20°C–23°C). In colder months, buildings must be heated, and in warmer months, they must be cooled. While outdoor temperatures can soar above 90°F (32°C) in summer or drop below 30°F (-1°C) in winter, the shallow ground beneath buildings remains a relatively constant 55°F (13°C) year-round. This natural stability presents a major opportunity to reduce emissions and energy costs through the use of geothermal technologies.

Established geothermal systems such as ground source heat pumps, geothermal district heating, and thermal energy networks can help meet heating and cooling demands efficiently.[48] (One company focusing on geothermal heating and cooling for buildings is Bedrock Energy, which has geothermal heating and cooling systems in Texas, Utah, and Colorado and plans to expand into New Mexico by 2026.) Thermal energy networks are especially well suited for—and would benefit—New

THE IMPACT OF GEOTHERMAL HEAT PUMPS

An Important Study from Oak Ridge National Laboratory

In 2023, Oak Ridge published *Grid Cost and Total Emissions Reductions Through Mass Deployment of Geothermal Heat Pumps for Building Heating and Cooling Electrification in the United States*. The study provided national-scale data on the impacts of widespread geothermal heat pump use. Using proportional scaling for New Mexico, it found:

Primary energy consumption reduction: New Mexico accounts for about 0.5% of the U.S. population. Assuming similar energy-use patterns, the state could see a 2.96 terawatt-hour (TWh) reduction in primary energy consumption annually by 2050.

Emissions reduction: Based on New Mexico's energy usage profile and Oak Ridge's projected 7 gigatons of CO_2-equivalent national reduction, the state could avoid 35 million metric tons of CO_2 emissions by 2050.

Electricity generation savings: Extrapolating from Oak Ridge's national 593 TWh savings, New Mexico could save approximately 3 TWh annually in electricity generation by 2050, particularly in cooling applications.

Peak demand mitigation: Heat pump deployment in New Mexico's high-temperature zones could contribute to reducing peak summer electricity demand by 5% to 10%, which would help alleviate grid stress during heat waves.

These estimates highlight the potential benefits of scaling geothermal heat pump use in New Mexico. These extrapolations are adjusted for New Mexico's size and energy usage patterns.

Liu, X., Ho, J., Winick, J., Porse, S., Lian, J., Wang, X., et al. (2023). Grid cost and total emissions reductions through mass deployment of geothermal heat pumps for building heating and cooling electrification in the United States. Oak Ridge National Laboratory. https://info.ornl.gov/sites/publications/Files/Pub196793.pdf

NEW MEXICO'S RESIDENTIAL COOLING DEMAND BY COUNTY

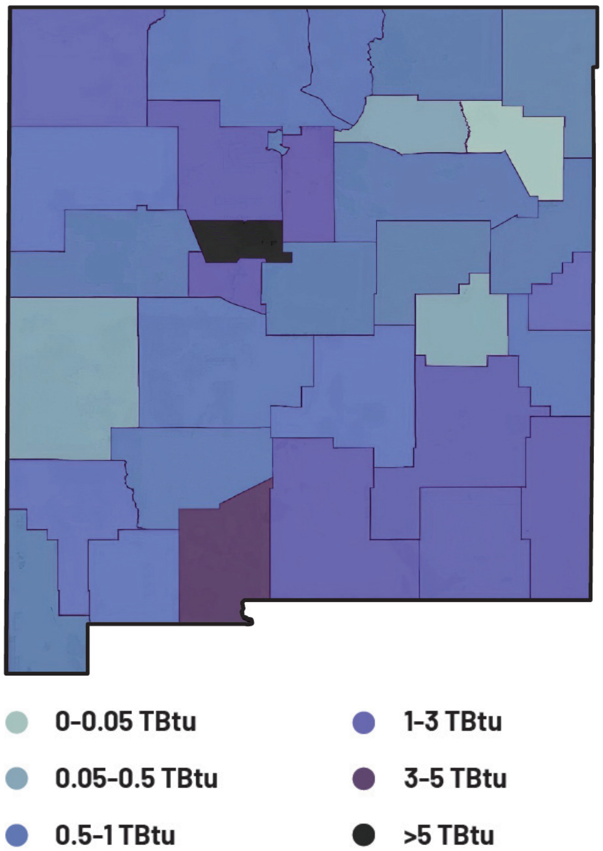

Figure 4.12: New Mexico residential cooling demand, by county. Source: Project InnerSpace. (2025). *Residential: County Cooling Total* [Data set]. Surface Module (United States of America). GeoMap. https://geomap.projectinnerspace.org/geomap/.

NEW MEXICO'S COMMERCIAL COOLING DEMAND BY COUNTY

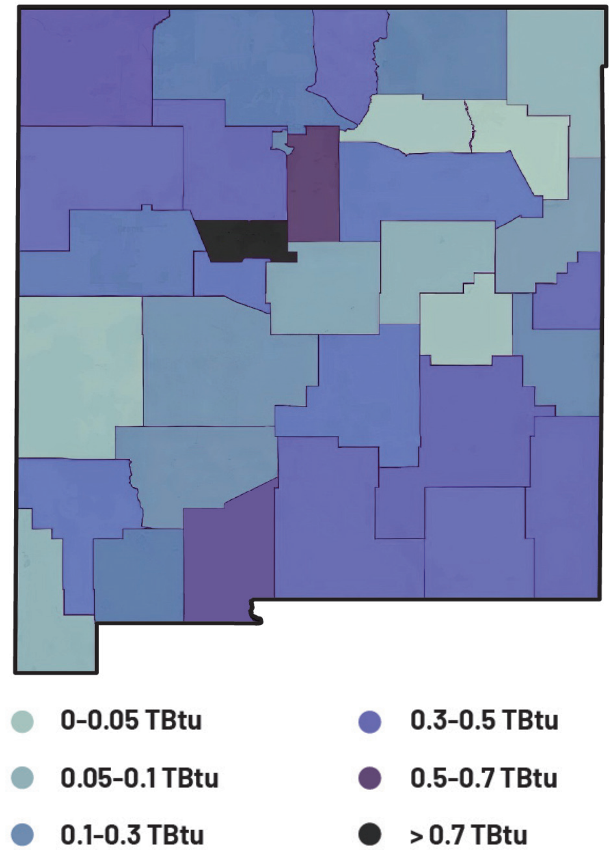

Figure 4.13: New Mexico commercial cooling demand, by county. Source: Project InnerSpace. (2025). *Commercial: Cooling Demand* [Data set]. Surface Module (United States of America). GeoMap. https://geomap.projectinnerspace.org/geomap/.

Mexico's urban areas, including Albuquerque, Las Cruces, Santa Fe, Roswell, Farmington, Hobbs, and Carlsbad. Taken together, these cities comprise about half of New Mexico's population. Other communities might adopt ground source heat pumps on a building-by-building basis. **Figures 4.12** through **4.15** highlight areas in New Mexico where these opportunities align with concentrated demand for heating and cooling.

Transitioning to geothermal climate control would significantly accelerate achievement of the state's climate goals, particularly considering that 76% of residential heating produces emissions.[49] More broadly, New Mexico should prioritize incorporating geothermal in areas considered "low-hanging fruit"—that is, regions and industries operating below 302°F (150°C) that overlap with accessible geothermal resources—to maximize the near-term effects of direct-use geothermal heating and cooling.

AGRICULTURAL HEATING BY TEMPERATURE RANGE AND COUNTY

Agriculture uses a lot of energy, especially in states such as New Mexico where heating is essential for both crop production and post-harvest processing. The state's agricultural sector relies heavily on energy for irrigation and heating, with 92% of the land classified as

NEW MEXICO'S RESIDENTIAL HEATING DEMAND BY COUNTY

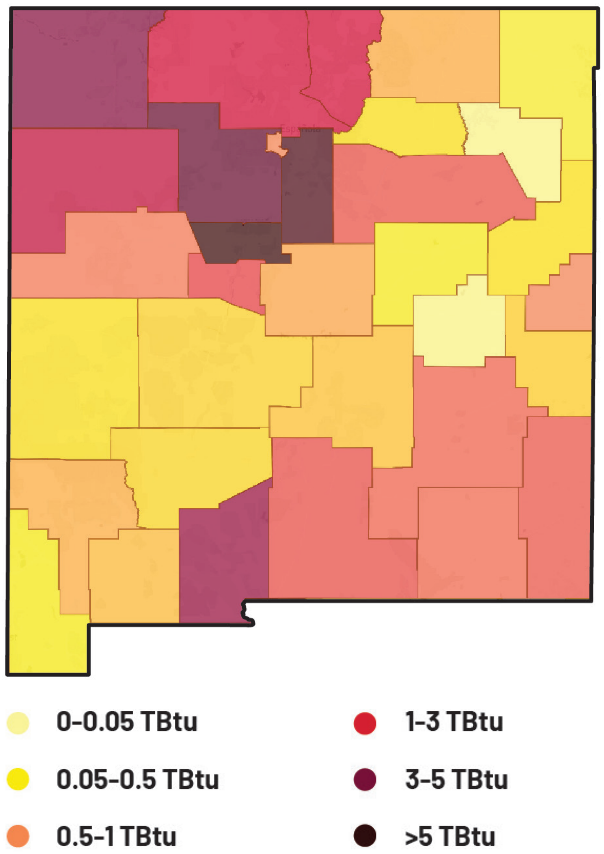

Figure 4.14: New Mexico residential heating demand, by county. Source: Project InnerSpace. (2025). *Residential: County Heating Total* [Data set]. Surface Module (United States of America). GeoMap. https://geomap.projectinnerspace.org/geomap/.

NEW MEXICO'S COMMERCIAL HEATING DEMAND BY COUNTY

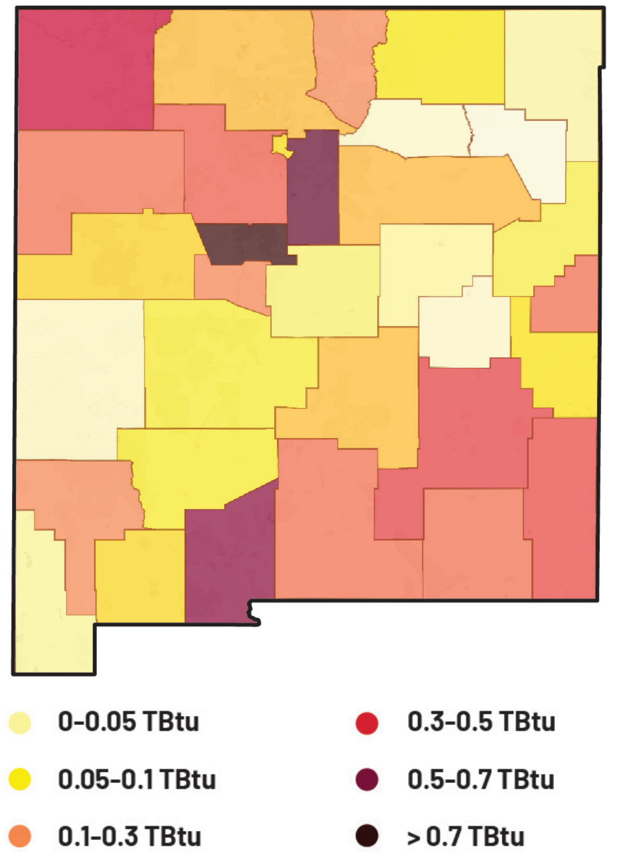

Figure 4.15: New Mexico commercial heating demand, by county. Source: Project InnerSpace. (2025). *Commercial: Space Heating Demand* [Data set]. Surface Module (United States of America). GeoMap. https://geomap.projectinnerspace.org/geomap/.

rangeland suitable for grazing.[50] Farmers and ranchers throughout the state also cultivate vital feed crops such as hay, corn, and grain sorghum to support livestock. The state's arid climate and high summer temperatures require energy-intensive practices to maintain these high levels of productivity.

Most agricultural thermal demand is in the 212°F-300°F (100°C-150°C) range, which is used in applications such as crop drying, greenhouse climate control, and food processing. Cooling requirements in agriculture (e.g., for cold storage of produce, milk chilling) are concentrated in the 32°F-75°F (0°C-24°C) range. In New Mexico's agricultural facilities, maintaining these controlled temperatures is essential to ensure productivity and product quality. Geothermal heating systems can efficiently provide heat for livestock barns, greenhouses, and crop drying facilities, and geothermal cooling (or heat exchange via ground source heat pump technology) can help regulate temperatures in food storage and processing units. As agricultural practices evolve, there will be even more potential for adopting renewable energy sources such as geothermal to reduce the carbon footprint in these heating-intensive food-processing industries.

Figures 4.16 and **4.17** show there's an overlap of favorable geothermal potential with demand, indicating

NEW MEXICO GEOGRAPHICAL DISTRIBUTION OF AGRICULTURAL HEATING DEMAND

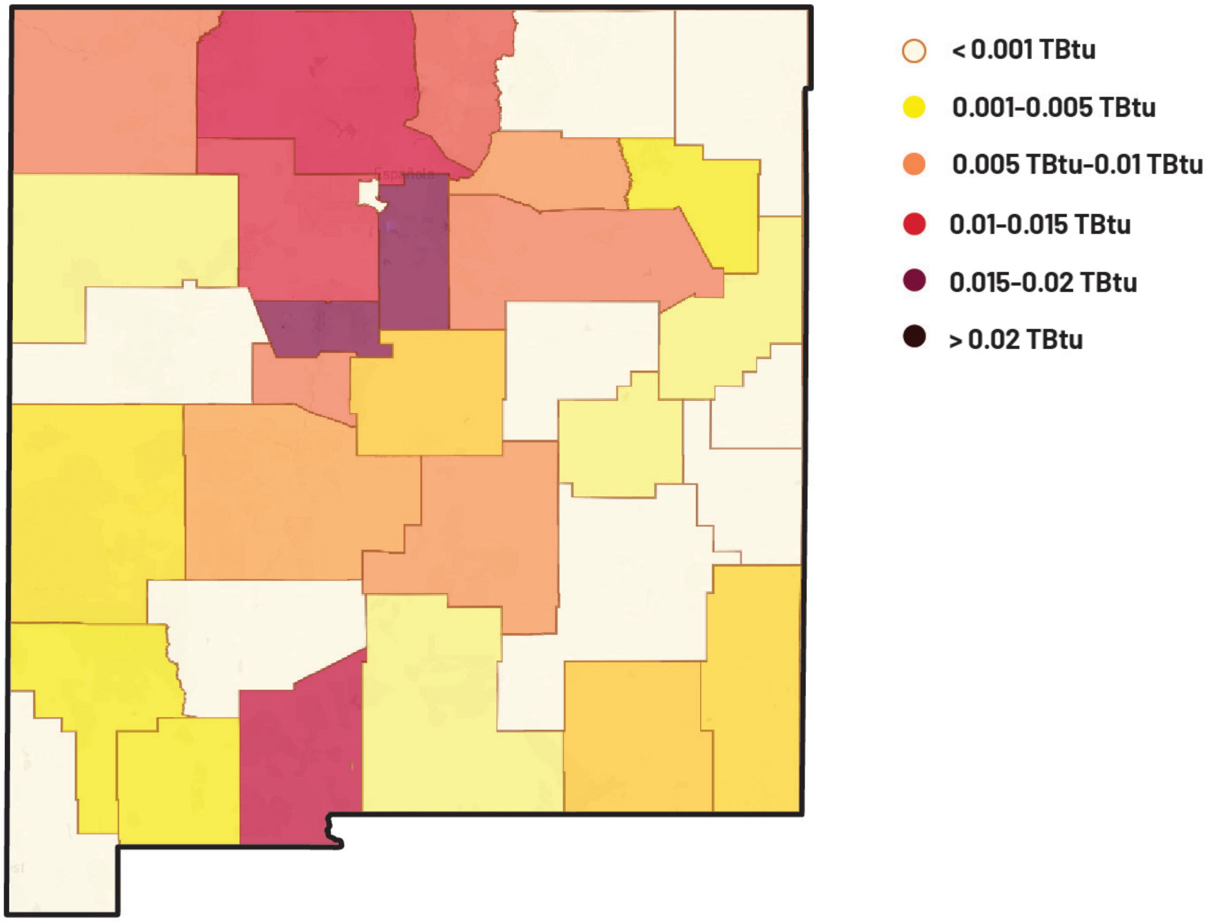

Figure 4.16: New Mexico geographical distribution of agricultural heating demand. The top five agricultural counties in New Mexico in terms of heat demand are Santa Fe (0.01459 TBtu), Bernalillo (0.01459 TBtu), Doña Ana (0.01094 TBtu), Rio Arriba (0.0099 TBtu), and Sandoval (0.00886 TBtu). Source: Project InnerSpace. (2025). *Agricultural Heating Demand* [Data set]. North America Surface Module (United States of America). GeoMap. https://geomap.projectinnerspace.org/geomap/

an opportunity for the state to reduce its reliance on natural gas, electricity, and propane for heating in these operations. The relatively low heating and cooling temperature needs of New Mexico's agriculture sector make it an ideal candidate for using ground source heat pumps and direct-use geothermal systems.

CONCLUSION

New Mexico's path to scaling geothermal direct-use systems lies in aligning thermal demands with geothermal opportunities. In counties such as Chaves, Curry, Roosevelt, McKinley, Bernalillo, and Doña Ana, there is a clear overlap between industrial and agricultural thermal energy needs—particularly in the 32°F to 480°F (0°C to 249°C) range—and the availability of subsurface geothermal heat. These counties host activities with high heat demand—such as dairy processing, pulp and paper manufacturing, and crop dehydration—for which geothermal has proven viability.

Although New Mexico generates a significant share of its electricity from solar and wind, these intermittent sources have limited utility for industrial thermal energy needs due to challenges with grid integration, storage, and the requirement for consistent heat, among other

GEOTHERMAL OPPORTUNITIES IN NEW MEXICO

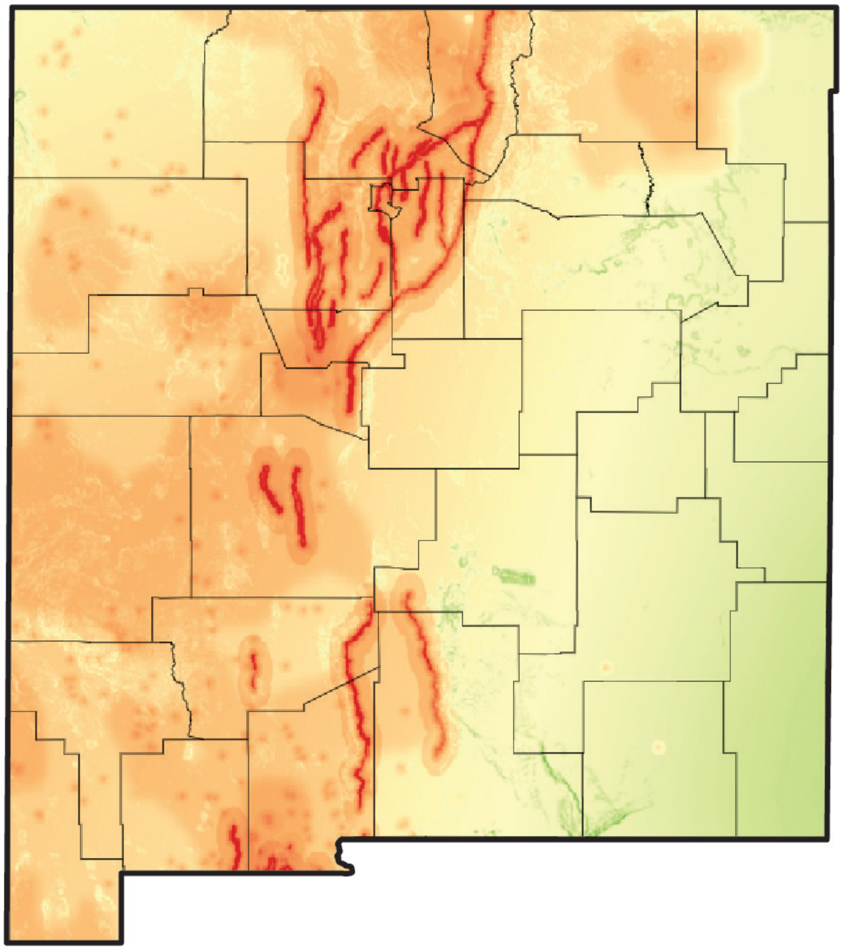

Figure 4.17: Geothermal opportunities in New Mexico. Source: GeoMap

factors. Geothermal direct-use delivers reliable, around-the-clock heat at a range of temperatures, making it particularly well suited for industrial processes that need uninterrupted thermal energy.

Despite its potential, geothermal currently supplies only 0.09% of New Mexico's industrial energy needs.[51] The state's industries stand to benefit greatly from transitioning to this untapped resource. Counties such as McKinley, Bernalillo, and Doña Ana are particularly well positioned for near-term deployment of geothermal. Add to that, the urban areas across New Mexico would benefit from the installation of thermal energy networks and ground source heat pumps, as these would be economical, stable, and secure and would reduce local, state, and regional GHG emissions.

It's worth repeating: Almost every county in New Mexico could effectively use geothermal heat for local demand. The state already has a geothermal industry primed to expand. To do so, New Mexico's policymakers and geothermal producers should prioritize development in the counties where the heat demand matches the most beneficial geothermal supply. These place-based strategies can reduce emissions, drive down energy costs, and create durable local jobs. With its abundant subsurface resources and a growing need to decarbonize heating across industries, agriculture, and buildings, New Mexico is uniquely positioned to become a national leader in geothermal direct use.

The Big Overlap: Areas, Industries, and Types of Geothermal

Location	Industry	Geothermal Type
Bernalillo County	Food processing industries (e.g., frozen goods and cereals); low-temperature industrial heating; inorganic chemical manufacturing; greenhouse heating, crop drying, and food storage	**32°F–120°F** Direct use, simple piping, minimal treatment **120°F–210°F** Heat exchangers, reinforced piping, filtration **210°F–482°C** Multiple wells, reinjection, industrial-grade controls
Chaves County	Dairy product manufacturing	**212°F–300°F** Multiple wells, reinjection, industrial-grade controls
Curry County	Dairy product manufacturing	**212°F–300°F** Multiple wells, reinjection, industrial-grade controls
Doña Ana County	Food processing industries (e.g., frozen goods and cereals); greenhouse and nursery heating, crop drying (pecans, green chiles, onions), viticulture, and food storage	**32°F–120°F** Direct use, simple piping, minimal treatment **212°F–300°F** Multiple wells, reinjection, industrial-grade controls
Eddy County	Oil and gas operations	**32°F–120°F** Direct use, simple piping, minimal treatment
Lea County	Oil and gas operations	**32°F–120°F** Direct use, simple piping, minimal treatment
McKinley County	Water treatment; heating at the Gallup Inland Port; paper processing	**32°F–120°F** Direct use, simple piping, minimal treatment **212°F–482°F** Multiple wells, reinjection, industrial-grade controls
Rio Arriba County	Greenhouse heating (tomatoes and cucumbers), crop drying (hay, grains, chicos, beans), livestock (barnhouse and water supply heating), and food storage	**32°F–120°F** Direct use, simple piping, minimal treatment **122°F–210°F** Heat exchangers,reinforced piping, filtration
Roosevelt County	Dairy product manufacturing	**212°F–302° F** Heat exchangers,reinforced piping, filtration
Sandoval County	Greenhouse and nursery heating, crop drying (hay and grains), livestock production, and food storage	**32°F–120°F** Direct use, simple piping, minimal treatment **122°F–212°F** Heat exchangers,reinforced piping, filtration
Santa Fe County	Food processing industries (e.g., frozen goods and cereals); greenhouse heating, crop drying, and food storage	**32°F–120°F** Direct use, simple piping, minimal treatment **302°F–482°C** Multiple wells, reinjection, industrial-grade controls
City centers such as Albuquerque, Las Cruces, and Santa Fe	High residential and commercial heating and cooling loads	**32°F–120°F** Direct use, simple piping, minimal treatment

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