General Solar, inc.

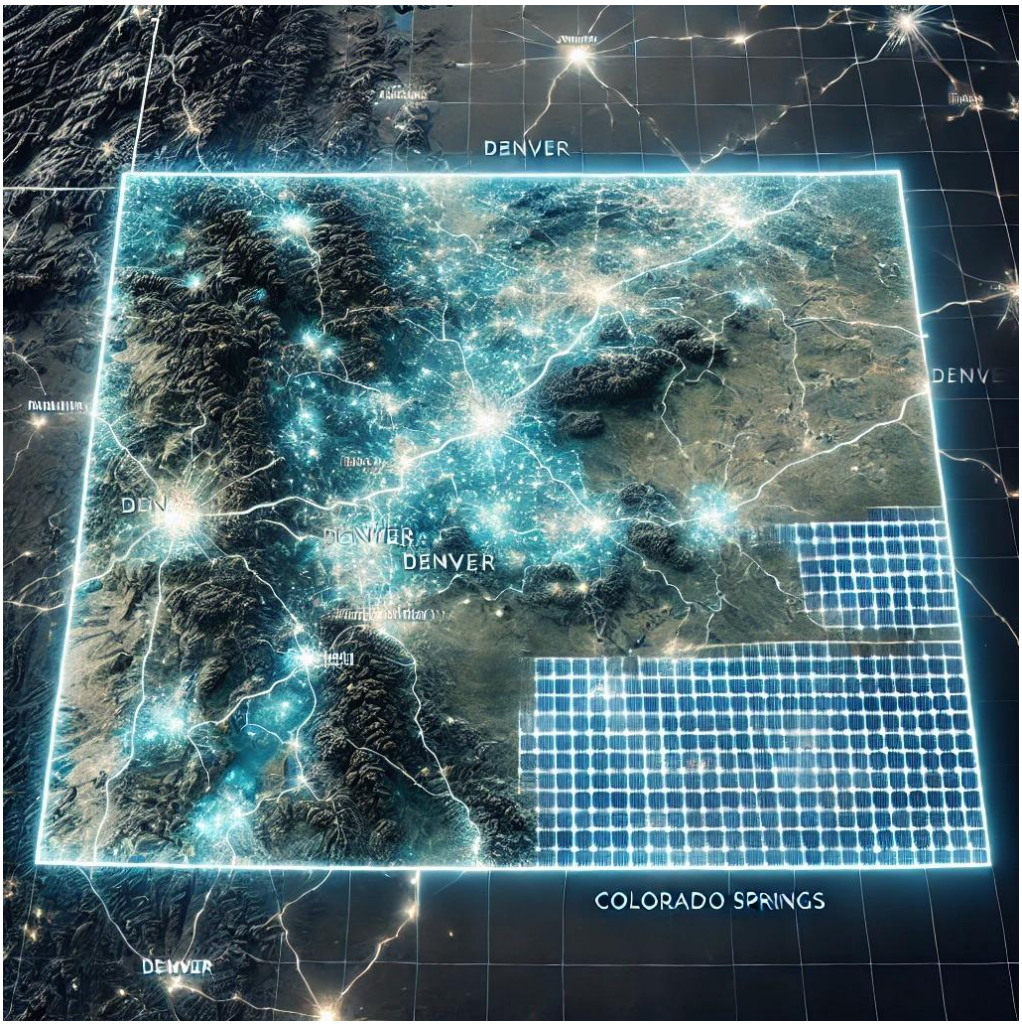
The Solar PV industry in Colorado, USA

Written by: Tariq Anwar

November 02, 2024

MECH 5250: Grid Connected Solar Electric Systems,

Prof: Walter Thomas



The State of Colorado:

Colorado is the eighth-largest state, encompassing an expansive land area of 104,100 square miles.[1] landscape of Colorado is characterized by diverse terrain. The eastern portion of the state features expansive plains situated at an elevation exceeding half a mile above sea level along the Kansas border, which then transition into the mountainous regions that traverse the central part of Colorado. The western slope of the state is dominated by the Rocky Mountains, which include some of the highest peaks in the contiguous United States. This geographical diversity presents both challenges and opportunities for the development of renewable energy sources, particularly photovoltaic solar power.

Colorado's economy exhibits considerable diversity. Despite the energy-intensive nature of its mining and oil and gas sectors, the state's energy intensity, measured by the amount of energy required to generate a unit of its gross domestic product, is lower than approximately four-fifths of the other states.[2]

Coal-fired power plants contributed 32% to Colorado's total net electricity generation in 2023, a significant decline from 68% in 2010.[3] the same period, natural gas-fired generation grew from 16% to 44%, and wind power increased from 4% to 23% of the state's total net electricity generation.[4] The referenced Figure:1[5] depicts the energy generation facilities across sectors in Colorado.

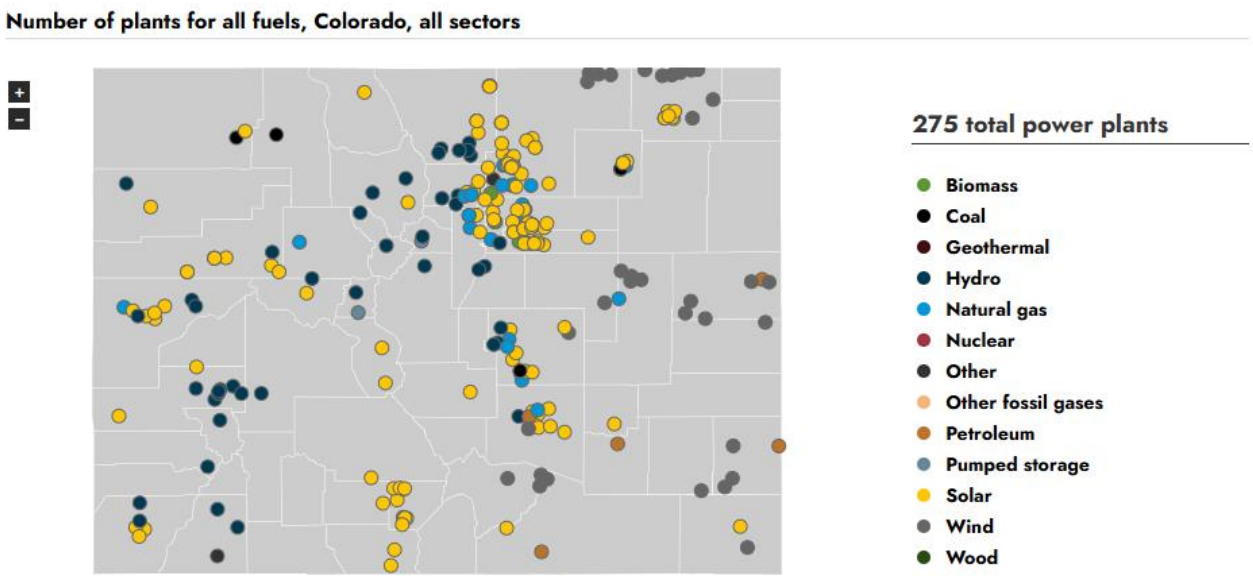


Figure:1, **Electricity Data Browser, Plant level data, Colorado, 2024.**

As per the US EIA Colorado state analysis [[6] In 2023, renewable energy resources contributed 39% of Colorado's total in-state electricity net generation. Wind power generated up to 70% of net electricity generation, followed by combined utility-scale solar (Size: 1MW or larger) and small-scale solar (Size: Less than 1MW), which accounted for 23% of net renewable energy electricity generation, 6% from hydroelectric power, and less than 1% from biomass.

As of August 2024, utility-scale solar photovoltaic facilities in Colorado have reached a summer generation capacity of around 2,181 MW per month. This marks a significant increase of roughly 290 MW compared to August 2023 [7]. As of August 2024, small-scale solar photovoltaic systems in Colorado are estimated to generate approximately 1,167.2 MW, a notable increase from the estimated 980.2 MW in August 2023.[7]

Monthly retail electricity sales in Colorado reveal a steady upward trend, with data from the U.S. Energy Information Administration (EIA) showing an increase from 4,409 million kWh in May to 5,871 million kWh in August. This rise reflects a seasonal demand pattern, likely driven by higher residential cooling needs during the warmer summer months.[8]

Residential electricity usage grew from 1,476 million kWh in May to 2,338 million kWh by August, indicating a significant rise as temperatures increased. Similarly, commercial electricity demand rose from 1,616 million kWh in May to 2,087 million kWh in August. In contrast, industrial consumption remained relatively steady, with only slight variations between 1,310 million kWh and 1,440 million kWh. The transportation sector's usage held constant at 7 million kWh each month.[8]

The EIA chart; Figure:2 [[9] provides a long-term view of these patterns from 2001 to 2024, with monthly electricity sales indexed to January 2001 as a baseline percentage. Peaks in electricity sales occur consistently each year, likely corresponding to summer, suggesting a regular seasonal increase in demand. Over time, these summer peaks show a slight upward trend, reflecting a gradual increase in electricity consumption, potentially due to population growth and greater cooling needs.

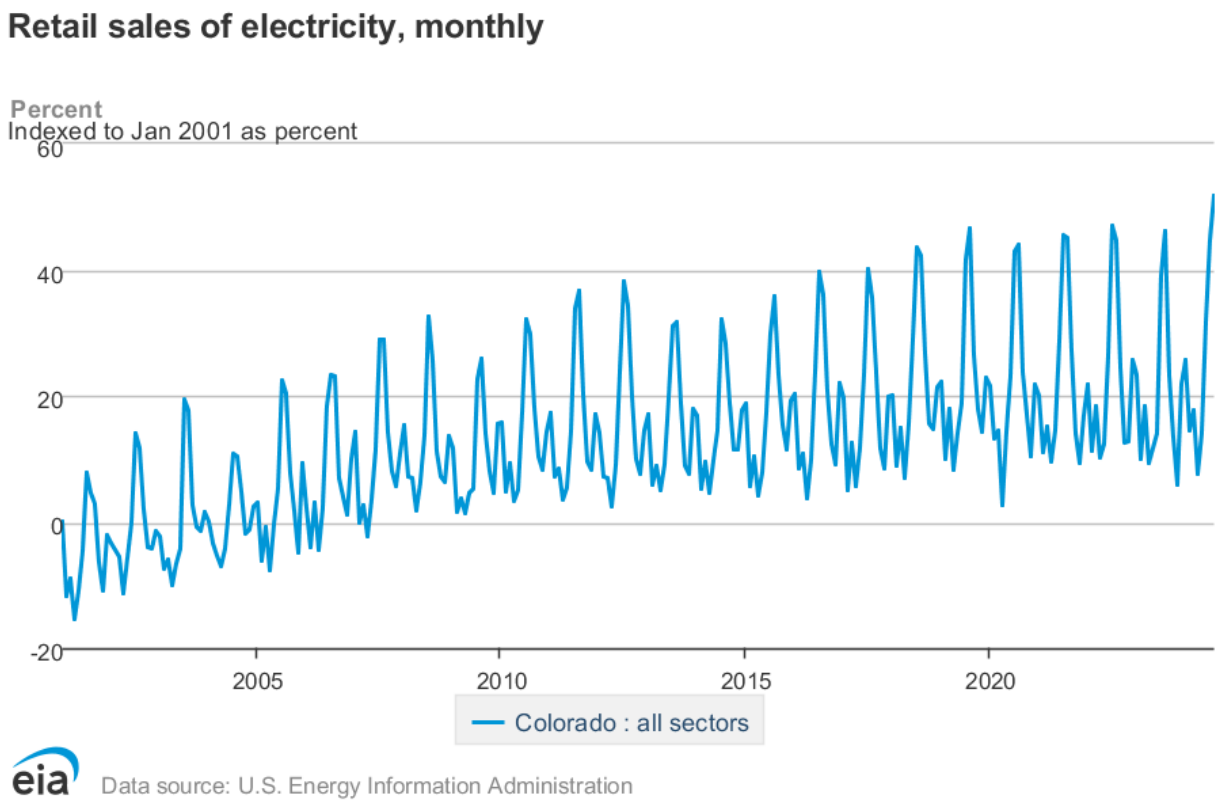


Figure:2, Retail sales of electricity, monthly.[9]

The data in Figure:3 indicates clear variations in electricity prices across different sectors in Colorado. Residential customers face the highest prices, with rates rising from 14.74 cents per kWh in May 2024 to 15.65 cents per kWh by August. In contrast, commercial customers pay slightly lower rates, ranging from 11.70 cents to 12.74 cents over the same period. Industrial consumers benefit from the lowest electricity prices, starting at 8.82 cents per kWh and increasing to 9.33 cents by the end of the summer. Notably, transportation sector prices remain relatively stable, but are higher than industrial rates, fluctuating between 9.22 and 9.51 cents per kWh.

Across all sectors, there is a general trend of modest price increases from May to August 2024, potentially driven by higher energy demand during the summer months or other cost factors. For

instance, the "All sectors" average price starts at 11.86 cents in May, peaks at 13.06 cents in July, and then holds steady in August. This sectoral price variation is a common pattern, as residential electricity is often priced higher due to smaller-scale consumption and additional distribution expenses. Conversely, industrial users can leverage bulk purchasing and potentially lower distribution costs to benefit from the lowest electricity rates.

Average retail price of electricity (cents per kilowatthour)	May 2024	Jun 2024	Jul 2024	Aug 2024
United States				
Mountain				
Colorado				
All sectors	11.86	13.06	13.06	13.06
Residential	14.74	15.21	15.47	15.65
Commercial	11.70	13.17	13.00	12.74
Industrial	8.82	9.61	9.32	9.33
Transportation	9.22	9.39	9.60	9.51
Other	-	-	-	-

Figure:3, Average retail price of electricity (cents/Kwh).[10]

The map shown as Figure 4 was obtained from the US Energy Information Administration's website. It depicts the average retail electricity price across all sectors in the United States, illustrating the change from 3.78 cents per kilowatt-hour in 2001 to 42.64 cents per kilowatt-hour in 2024. Additionally, the map highlights Colorado's current average retail electricity price of 13.06 cents per kilowatt-hour.

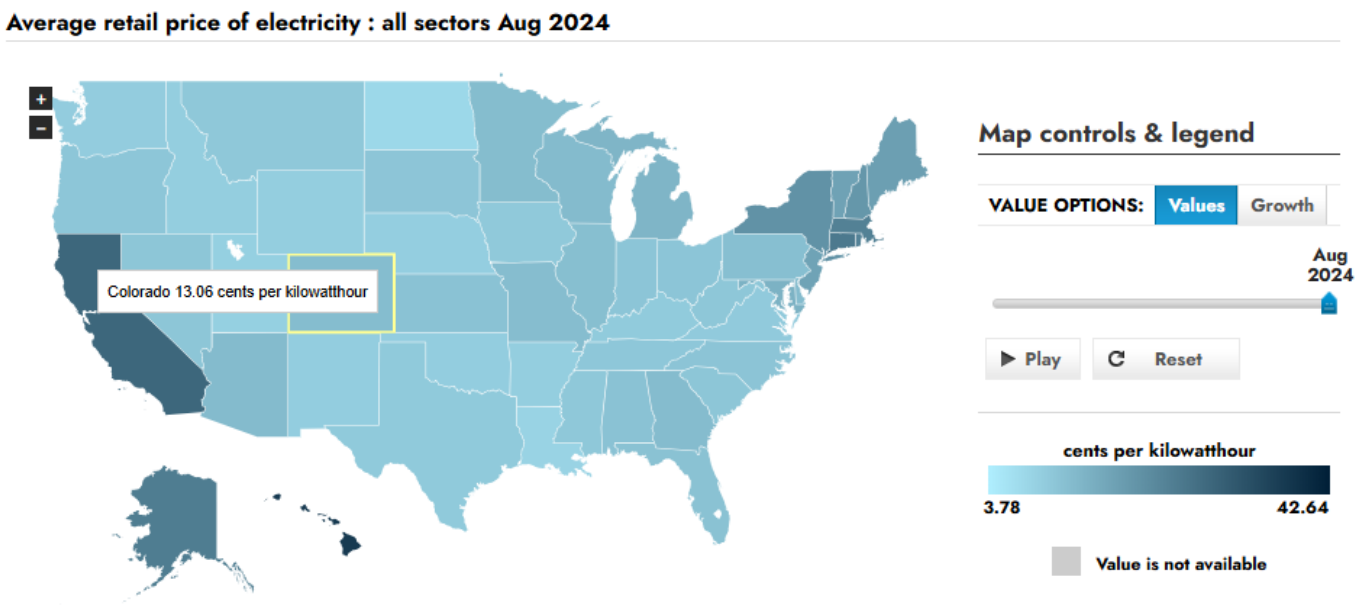


Figure:4, Average retail Price of electricity [10]

Big Horn Solar Project; 300MW:[11]

Lightsource BP, in partnership with McCarthy Building Companies, has launched the 300MW Bighorn Solar project in Colorado, USA. This initiative represents the first of two large-scale solar developments the companies are undertaking in the region. The Bighorn Solar project is noteworthy as the largest on-site solar installation in the country dedicatedto a single customer, providing power to EVRAZ, the first U.S. steel mill to operate using solar energy. This arrangement allows EVRAZ to benefit from stable and affordable electricity rates, supporting its local workforce of over a thousand employees and enabling company expansion.

To enhance the site's biodiversity, the project partners introduced a custom seed blend designed to suit the local climate, ecosystem, and soil conditions. The mix includes native grasses such as western wheatgrass, buffalo grass, and little bluestem, along with purple prairie clover to attract

pollinators, supporting habitat conservation throughout the project's duration.

Figure:5, Big Horn solar Project [[11]

Sun Mountain Solar Project (293MW):[12] (https://youtu.be/kDl4ZodjRPw.)

Lightsource bp, a renewable energy company, has developed the 293-megawatt Sun Mountain solar project in Pueblo, Colorado, marking its second venture in the area. This project, along with the Bighorn Solar installation, represents a $500 million private investment in Colorado's renewable energy. Lightsource bp owns and operates the Sun Mountain facility, supplying solar power to Xcel Energy through a long-term contract. Xcel Energy then distributes this energy to customers across eight states in the Western and Midwestern United States. The Sun Mountain project aligns with Xcel Energy's Colorado Energy Plan to source 80% of electricity from

renewables and reduce carbon emissions by 85% by 2030. It also contributes to Colorado's emission reduction goals, which are designed to create healthier communities and boost local economies. Additionally, Lightsource bp's Bighorn Solar project supplies 300 megawatts to Xcel Energy, primarily for the EVRAZ Rocky Mountain Steel mill. Across both projects, Lightsource bp is preserving over 3,000 acres of shortgrass prairie, creating wildlife habitats, and enhancing carbon sequestration.

Forbes, Review of the Top Solar Installation companies in Colorado:[13]

The Colorado solar panel installation market features a diverse array of companies, each with its own distinct strengths. Tesla is recognized for its widespread availability and robust distribution network, making it easy for customers to access their solar products, including both solar panels and the integrated Solar Roof technology. Blue Raven Solar has garnered high ratings for customer satisfaction, focusing on providing a seamless experience from consultation to installation and offering attractive financing options. Palmetto Solar is noted for its high-quality solar equipment and technology, emphasizing the use of top-tier components to ensure efficiency and durability, while also providing tools for monitoring solar performance. Photon Brothers, a local Colorado-based company, specializes in residential solar installations and is praised for its personalized service and local expertise, tailoring solutions to meet the specific needs of Colorado homeowners. Green Home Systems offers a wide selection of solar panels from various manufacturers, allowing customers to choose products that best fit their energy needs and budget, in addition to providing comprehensive energy efficiency solutions. Finally, Sunrun is known for offering flexible financing options, including leases and power purchase agreements,

making solar energy more accessible to homeowners who may not want to pay upfront costs. These companies represent some of the leading options for solar panel installations in Colorado, each excelling in different areas to meet the diverse needs of homeowners in the state.

Figure 6 presents the Annual solar installation graph from 2014 to 2023; it is clearly visible there is a dramatic increase in the solar installation capacity from less than 200MW to over 1600MW in 2023.

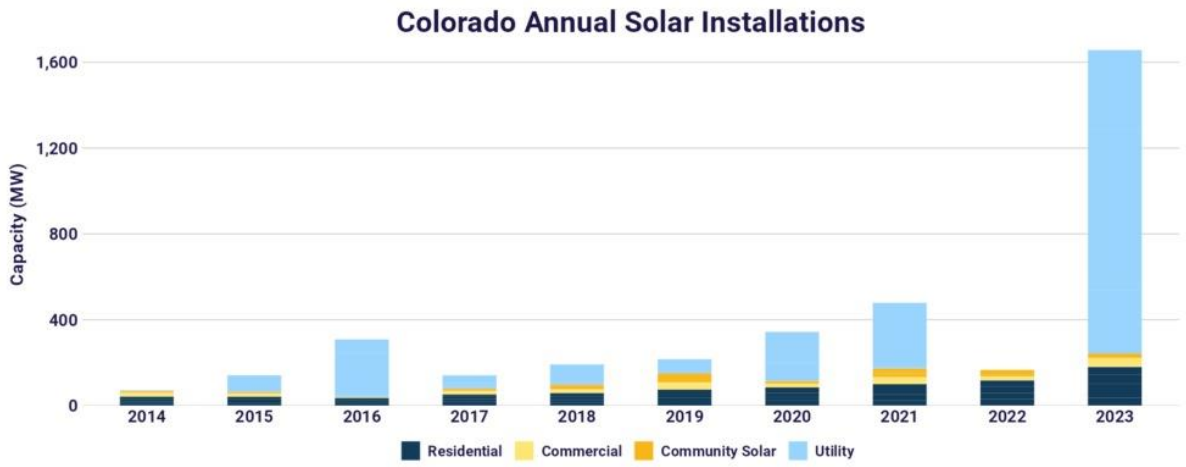


Figure:6, Colorado Annual Solar Installations.[14]

Solar Incentive, Tax Credits & Rebates:[15]

The federal Solar Investment Tax Credit offers a 30% deduction on the total cost of solar equipment, labor, and installation. Local utilities provide additional incentives: Black Hills Energy offers $0.03/kWh for 10 years on systems up to 30 kW, Holy Cross Energy provides $250/kW for 0-6 kW systems and $100/kW for 6-25 kW systems, while Xcel Energy offers $1,000/kW up to 7 kW for eligible customers. Local government incentives include Boulder

County's $200 rebate through EnergySmart and Summit County's $1,500-$1,650 rebate via Solarize Summit (until June 30, 2024). Colorado offers sales and property tax exemptions for solar installations. Net metering is available statewide, with rules varying by utility; Xcel Energy and Black Hills Energy provide full retail rate credits, with monthly rollovers and annual payouts at lower rates for excess credits. Energy storage incentives include Xcel Energy's offer of up to $500/kW (50% of equipment cost) and Holy Cross Energy's $250-$500/kW for systems up to 25 kW. Smaller utilities (< 5,000 customers) aren't required to offer net metering, and municipal/co-op utilities cap eligible systems at 10 kW. These incentives make solar power more affordable and attractive for Colorado residents, encouraging renewable energy adoption across the state.

Challenges for General Solar;

The primary challenges facing General Solar in establishing a presence in Colorado are the intense competition from established solar companies like Lightsource BP. Lightsource BP has already launched two large-scale solar projects in Pueblo, Colorado, with a combined capacity of 300MW. Furthermore, Lightsource BP's Bighorn Solar project supplies solar power to Xcel Energy through a long-term contract, enabling Xcel to distribute this renewable energy across eight states in the Western and Midwestern United States [[12]. These long-term agreements can pose a significant hurdle for General Solar to overcome. However, the generous tax incentives and rebates available in Colorado may help offset these competitive pressures and encourage more Colorado residents to embrace renewable energy solutions. Despite the challenges, the state's pro-solar policies and growing demand for clean energy could create opportunities for General Solar to carve out a niche in the Colorado solar market.

Market Penetrating Strategy:

The key to successfully establishing a presence in the Colorado market is for General Solar to clearly demonstrate the benefits of solar energy to local residents. The company should emphasize the substantial 30% federal tax credit available for solar installations, as well as Colorado's abundant 300 days of sunshine, which enables solar systems to generate more energy than needed, allowing homeowners to receive tax rebates by feeding excess power back into the grid. Additionally, General Solar should approach homeowner associations, which have a remarkably high membership rate of 60.7% in Colorado,[16] and propose the collective installation of solar panels to power the entire community. This strategy could leverage the state's average HOA size of 221 residents in 88 homes[16], as well as the higher average household size of 2.50 residents in HOA communities compared to the statewide average of 2.40[16]. Furthermore, General Solar should consider hiring legal and accounting professionals to assist their clients in navigating the available tax incentives and rebates, as the recent 1.97% increase in Colorado's homeownership rate to 67.2% [16] suggests a growing market opportunity for solar energy solutions.

REFERENCES:

[1] https://netstate.com/states/tables/st_size.htm.

[2] https://www.eia.gov/state/seds/sep_sum/html/pdf/rank_use_gdp.pdf.

[3] https://www.eia.gov/electricity/data/browser/#/topic/0?agg=2,0,1&fuel=g&geo=0000000000g&s

ec=g&freq=M&rtype=s&maptype=0&rse=0&pin=&ltype=pin&ctype=map&end=202408&start=200101.

[4] O'Keeffe, Michael K., and Karen A. Berry. "IS-83 Colorado Mineral and Energy Industry Activities 2019-2020." Mineral and Energy Industry. Information Series. Golden, CO: Colorado Geological Survey, 2021. https://coloradogeologicalsurvey.org/publications/colorado-mineral-energy-industry-activities-2020/.

[5] https://www.eia.gov/electricity/data/browser/#/topic/1?agg=2,0,1&fuel=g&geo=0000000000g&sec=g&freq=M&datecode=202408&rtype=s&start=200101&end=202408&ctype=map&ltype=pin&pin=&rse=0&maptype=0.

[6] https://www.eia.gov/state/analysis.php?sid=CO#110.

[7] https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=table_6_02_b.

[8] https://www.eia.gov/electricity/data/browser/#/topic/5?agg=0,1&geo=0000000000g&endsec=vg&linechart=ELEC.SALES.CO-ALL.M&columnchart=ELEC.SALES.CO-ALL.M&map=ELEC.SALES.CO-ALL.M&freq=M&start=200101&end=202408&chartindexed=1&ctype=linechart&ltype=sourcekey&rtype=s&maptype=0&rse=0&pin=.

[9] https://www.eia.gov/electricity/data/browser/#/topic/5?agg=0,1&geo=0000000000g&endsec=vg&freq=M&start=200101&end=202408&chartindexed=1&ctype=map&ltype=sourcekey&rtype=s&maptype=0&rse=0&pin=.

[10] https://www.eia.gov/electricity/data/browser/#/topic/7?agg=0,1&geo=0000000000g&endsec=vg&freq=M&start=200101&end=202408&chartindexed=1&ctype=map&ltype=sourcekey&rtype=s&pin=&rse=0&maptype=0.

[11] https://list.solar/news/lightsource-bp-35/.

12] https://lightsourcebp.com/project/sun-mountain-solar/.

[13] https://www.forbes.com/home-improvement/solar/best-solar-companies-colorado/#:~:text=Colorado%E2%80%99s%20Top%20Solar%20Panel%20Installation%20Companies%201%20Tesla%3A,of%20Panels%206%20Sunrun%3A%20Good%20for%20Financing%20Options.

[14] https://seia.org/state-solar-policy/colorado-solar/.

[15] https://www.energysage.com/local-data/solar-rebates-incentives/co/?rc=seia.

[16] https://ipropertymanagement.com/research/hoa-statistics.