STUDY OF RESIDENTIAL MARKET TRENDS SURROUNDING SIX UTILITY-SCALE SOLAR PROJECTS IN TEXAS

Erin M. Kiella, PhD; Jennifer N. Pitts, MAI, CRE; & Chris Yost-Bremm, PhD

Summary of Findings

- A market trend analysis of various utility-scale solar projects across a diverse geographic study area in Texas showed no evidence of negative market impacts for nearby residential properties. The analysis showed a robust and competitive market still exists for these nearby residential properties once solar projects begin development and after they are operational.

- Six utility-scale solar projects at various stages of development and operation in four Texas counties were considered.

- Sale metrics– price per interior square foot, sale to list price ratios, and days on market– in subject areas were compared to control area sales located further from solar projects. Results showed the subject areas trended similarly to the control areas.

- Study results were consistent across varying locations, residential markets, and for varying project stages.

- Market interviews with local market experts and agents associated with sales proximate to solar projects also confirmed the market trend results.

- Conclusions and findings from the body of published literature were also reviewed and summarized.

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Abstract

The rapid growth of utility-scale solar project installations, as well as the increase in project sizes both in the United States and particularly in Texas, has caused concern about potential impact from projects on proximate property values. The research available on the potential impact, if any, remains limited. The research performed here is an analysis of market trends surrounding Texas utility-scale solar projects in Tom Green, Bell, Lamar, and Bee Counties to understand how surrounding real estate markets may be affected when located near utility-scale solar projects. Key market indicators – sale price per interior square foot, sale to list price ratios, and days on market—for subject areas are compared to control areas of similar residential properties located further from the utility-scale solar projects. The study analysis shows market indicators for the subject areas trend similarly to control areas. These results indicate residential real estate markets, overall, are unaffected when located in proximity to a utility-scale solar project. There is potential for individual sales to be affected by the proximity to a utility-scale solar project, but overall, a robust and competitive market still exists for these properties. Several of the sales were confirmed through discussion with agents associated with the sales. Additionally, local market experts were surveyed to understand how the market was reacting to the development and operation of solar projects. These conversations confirmed the market trend results that overall, real estate markets have not been impacted by the development and operation of utility-scale solar project. Conclusions and findings from the body of published literature were also reviewed and summarized.

What is a typical utility-scale solar project?

Although there is no uniform definition for a utility-scale solar project, the industry tends to use two defining features to classify such projects—size and energy use. The Solar Energy Industries Association ("SEIA") defines "utility-scale" as solar projects generating over one megawatt ("MW") of solar energy. The National Renewable Energy Laboratory defines a project as "utility-scale" if it generates more than five MWs of solar energy. Utility-scale projects also typically sell electricity directly to the grid as opposed to supplying electricity to an individual facility.

Developers of utility-scale solar projects typically plan for at least 100 MW of electricity production, which requires approximately 800 to 1,000 acres of land. Leasing land for these projects is preferred by most developers. In some cases, developers purchase the land where a

substation is located. Developers are interested in land with access to transmission lines and with a topography that is flat to slightly sloping, ideally with a south-facing slope.[1]

Twenty-to-thirty-year leases with a fixed-rate lease structure are typical, as opposed to production-based rental agreements. Leases will have two lease rate structures based on the phase of the project—development and operation phases. Development phases are shorter, typically three to five years, with the operational phase typically lasting 20 to 30 years. The lease rates for the operational phase are allocated by decades (i.e., rate 1 for years 1-10, rate 2 for years 11-20, rate 3 for years 21-30) and include inflation adjustments. Leases also typically include options to extend the lease, with a rate identified for each extension. In addition to standard lease rates, transmission and access easements are included for the development phase. One-time payments for these easements are based on the land usage (i.e., length of road developed, or underground cable installed). If a substation facility or operations and maintenance ("O&M") facilities (O&M building, parking lot, equipment and storage yard, and other ancillary facilities) are installed, the tenant pays an annual payment per acre of the property occupied by such facilities during the operational phase. The area where the solar panels are located, known as the "Solar Panel Area" ("SPA"), is likely to be fenced off. The lease includes a waiver stating that the landlord waives their right to ingress and egress to, on, and over that portion of their property. Setbacks and setback requirement waivers are also typically included allowing facilities to be located anywhere on the property, including near the property line boundaries.

The tenant typically has the superior rights to use of the land. They have the right to transfer, convey, sublease, or assign the lease or any interest without the consent of the landlord. The landlord also has the right to assign and/ or transfer their interest in the lease or the underlying real property without the consent of the tenant.

If any land is designated under the United States Department of Agriculture's Conservation Reserve Program ("CRP"), the landlord must work with the tenant to remove the designation for purposes of construction, operation, or maintenance of the project. Typically, the tenant bears the cost of removing the land from the CRP designation and reimburses the landlord for any penalties or reinstated taxes as a result of the removal, but the tenant does not pay any foregone future program payments the landlord would have received. Typically, the tenant has no water rights unless otherwise agreed upon. If the landlord experiences any increase in ad valorem property taxes, assessed for the property after the operation date of the solar project, the tenant typically reimburses the landlord.

It is not uncommon for several projects to exist on a single site. In these instances, each project has a separate lease with the landlord. The leases may have the same terms but exist for each individual project. Projects may also extend over multiple properties; therefore, a project may extend across adjacent landowners' properties.

Texas state law requires the decommissioning process of a solar project to be bonded in a manner acceptable to the landlord. Doing so eliminates the potential for a landowner to be left with

[1] Lease structure and ideal solar project characteristics were summarized from leases used by the market and discussions with market experts.

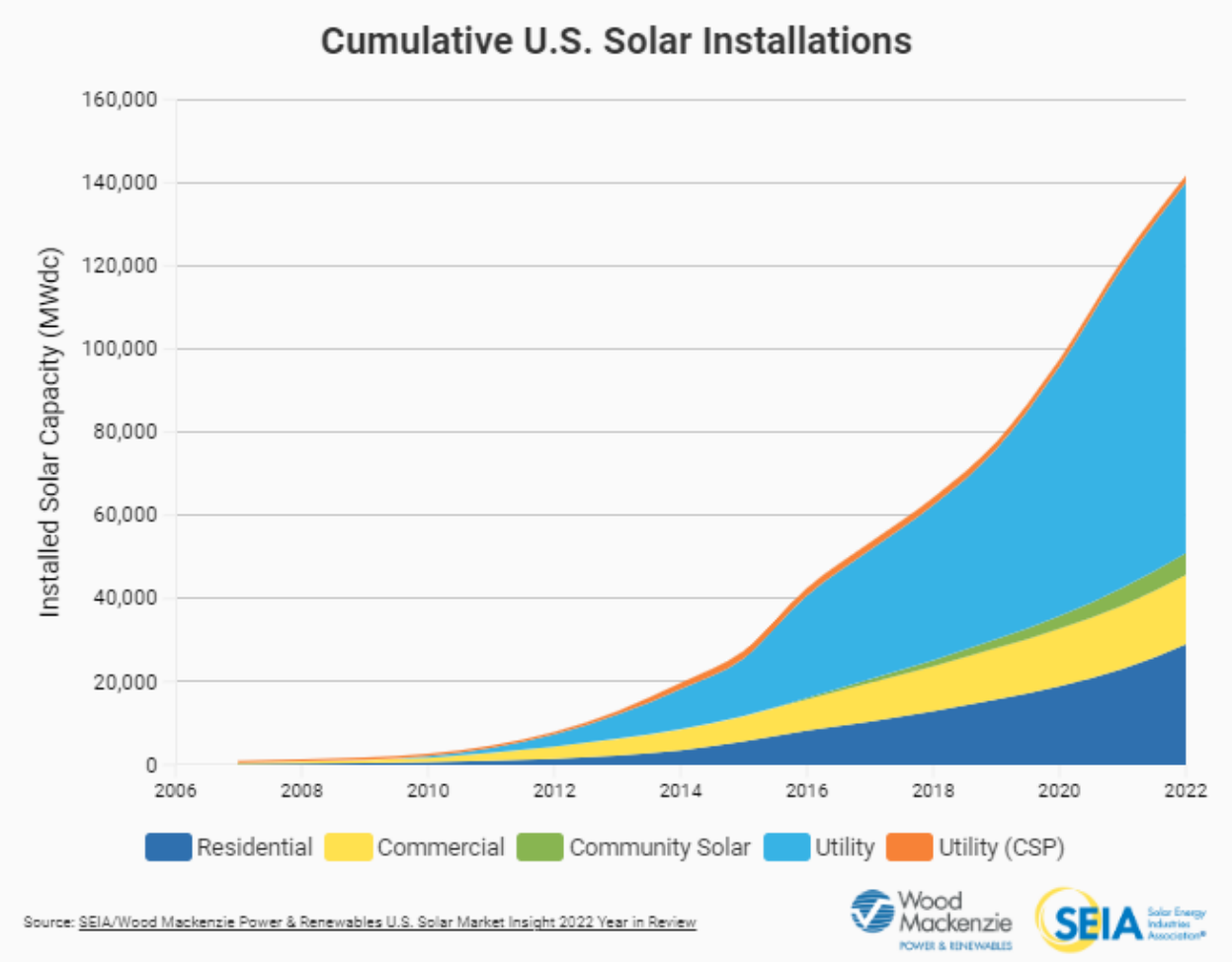
decommissioned solar panels on their property. The decommissioning process must also be referenced in the lease. The language states the tenant must restore the surface of the SPA, as is reasonably practicable, to its original condition at the inception of the lease. Damages resulting from the removal of the tenant's improvements must also be repaired to the extent reasonably practicable. The lease language may also state a timeframe (i.e., restoration must occur within a year). The level of restoration may also be dictated by city, county, or state level ordinance.

Solar production in the United States and Texas

As of 2022, there is approximately 135.7 gigawatts ("GW") of solar power capacity installed in the United States, translating to enough electricity generation to power 23 million homes. Solar installation and production in the United States continues to grow rapidly. In 2010, solar accounted for only 0.1% of the United States' electrical generation. In 2022, it accounted for 4.5%. Solar has also outpaced other energy generating sources in new electric capacity additions. In the third quarter of 2022, solar accounted for 46% of all new electric capacity added to the grid, with solar installations growing 33% annually, over the last decade.[2]

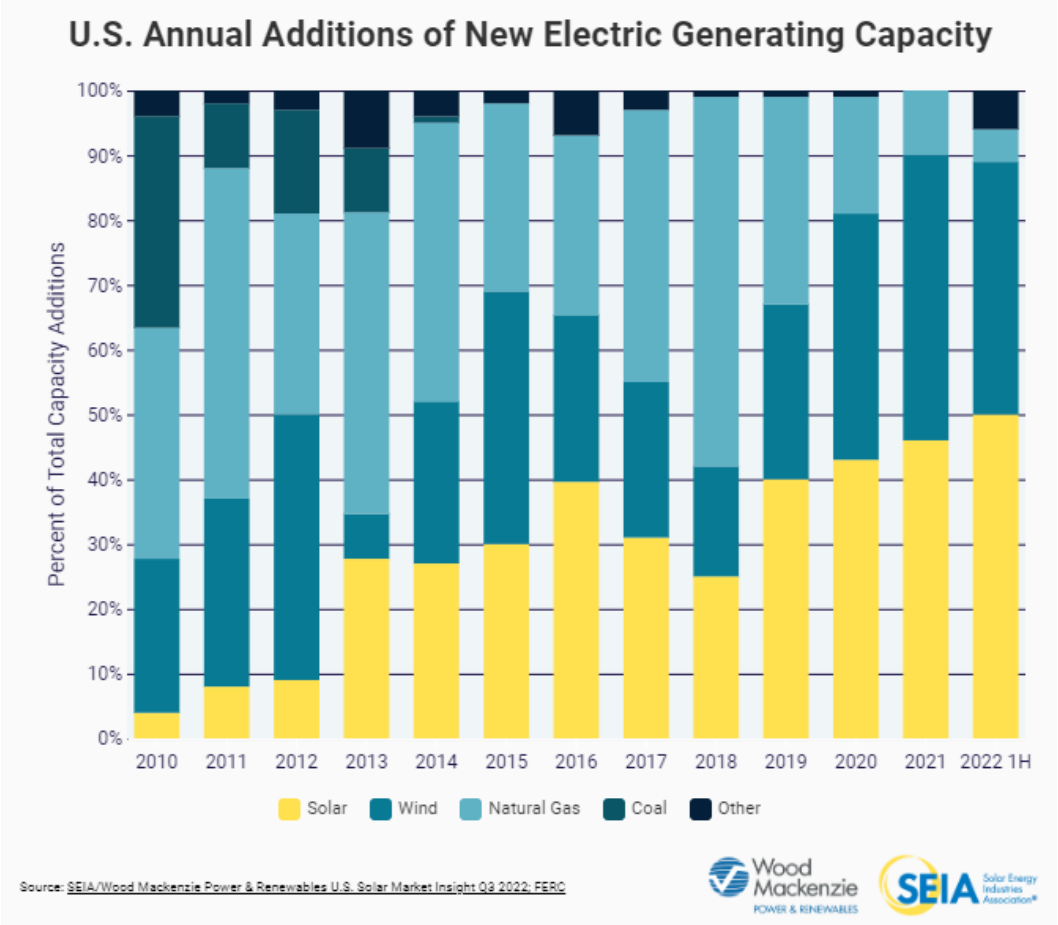
[2] https://www.seia.org/solar-industry-research-data

Figure 1. Cumulative U.S. solar installations[3]



[3] https://www.seia.org/solar-industry-research-data

Figure 2. U.S. annual additions of new electric generating capacity[4]



Texas has 16,173 MW of installed solar (11.9% of the installed solar in the United States) and ranks second in the United States for installed solar electricity capacity (ranking number 1 in 2021). This translates to enough electricity to power over 1.8 million homes and represents 4.7% of the state's electricity usage. Texas currently has 614 companies operating in the solar industry (96 manufacturers, 160 installers/ developers, and 358 other types of companies engaged in solar production). The state has 197 installations, with the industry recording approximately $19.1 billion in investment. In 2021, solar contributed 10,346 jobs to the Texas economy.[5]

[4] https://www.seia.org/solar-industry-research-data
[5] https://www.seia.org/state-solar-policy/texas-solar

Figure 3. SEIA's major solar projects list[6]

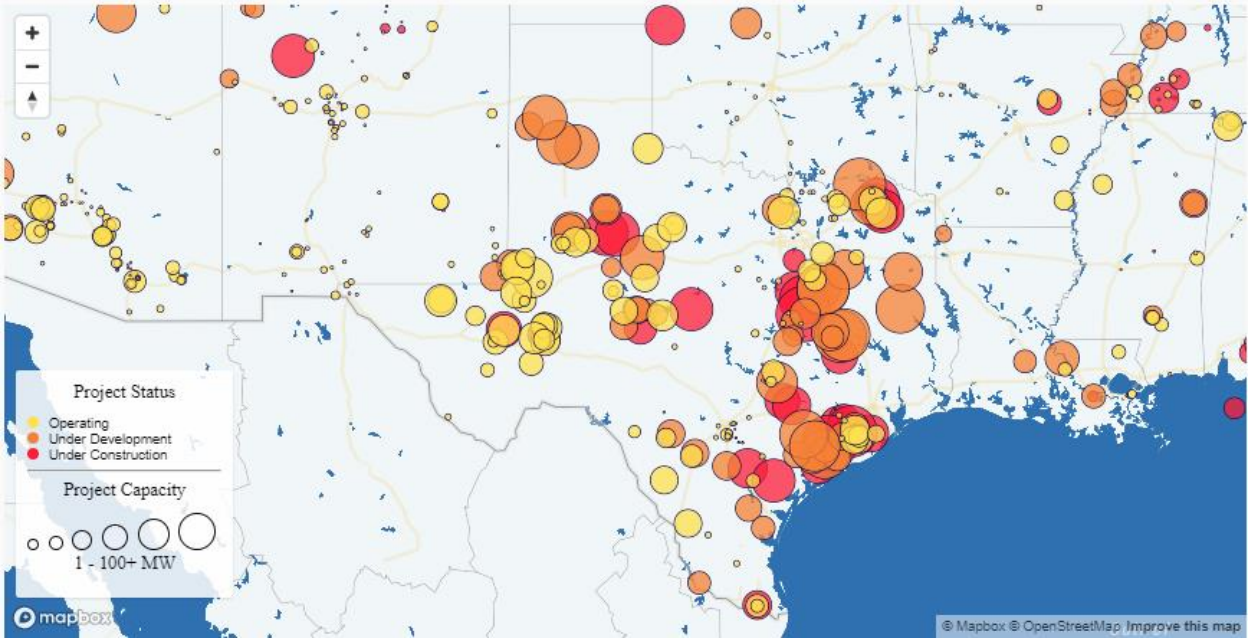
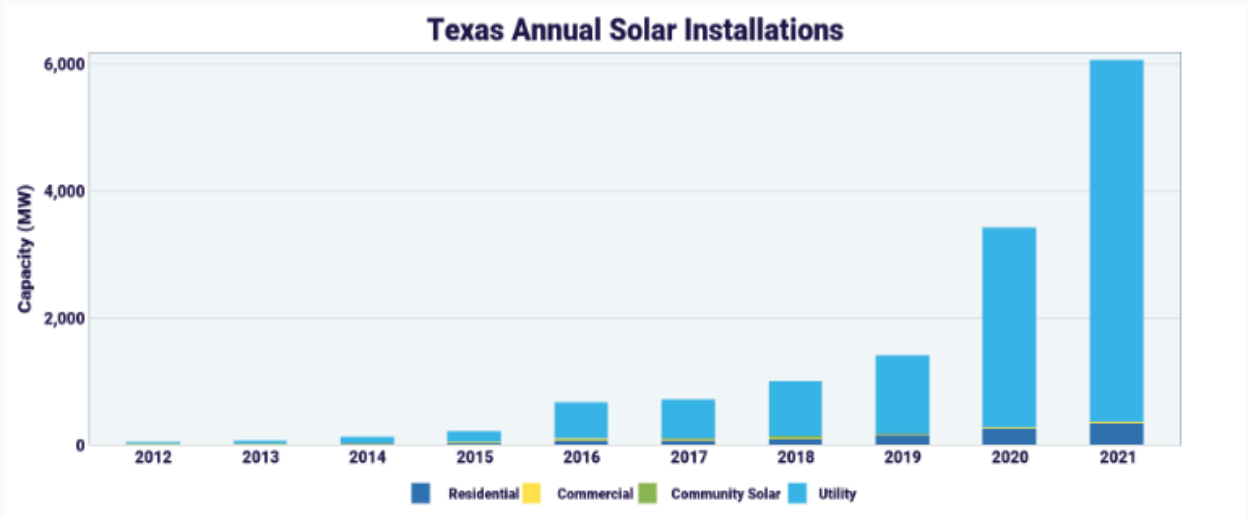


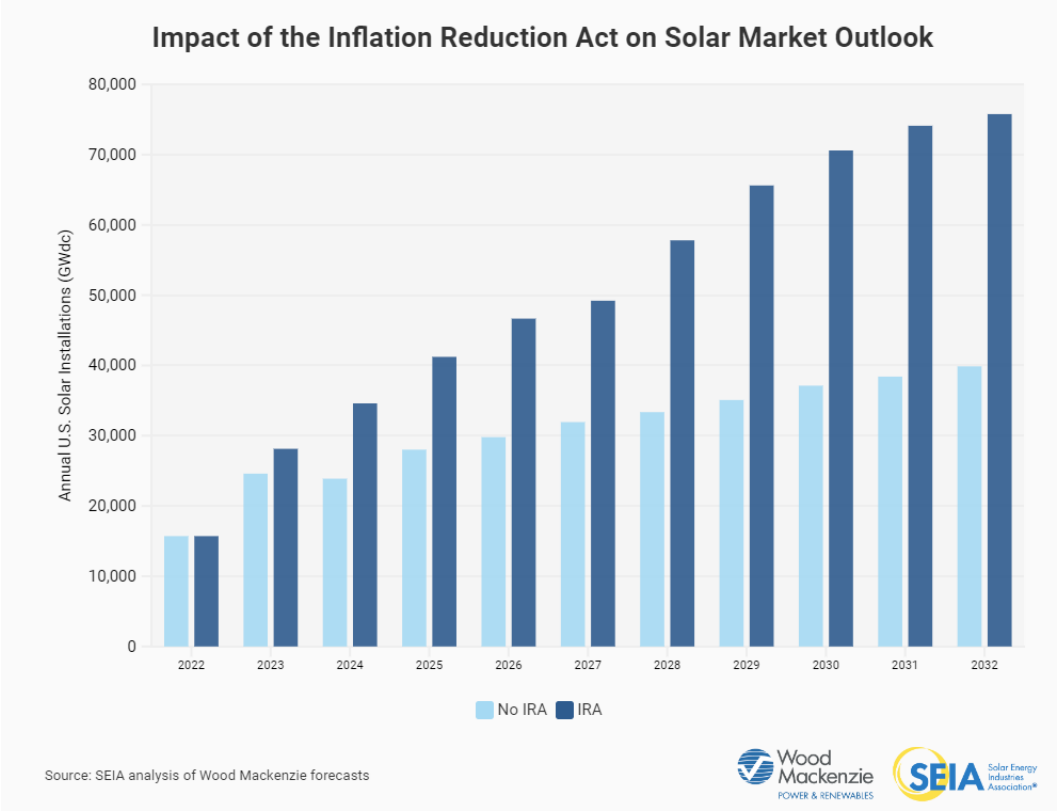
Figure 4. Texas annual solar installations[7]



[6] https://www.seia.org/research-resources/major-solar-projects-list
[7] https://www.seia.org/state-solar-policy/texas-solar

Over the last decade, costs associated with solar production and installation have declined by more than 60%. Solar prices are proving as competitive as other forms of energy generation as well.[8] These favorable market conditions and supportive public policies promote solar installations in new markets. The investment and production tax incentives provided by the Inflation Reduction Act ("IRA") will infuse $200 billion in new investment over the next decade and as a result is expected to increase solar deployment by at least 69% as compared to pre-IRA projections. The United States is expected to have nearly 682 GW of total solar capacity installed in the next decade, five times the amount currently installed.[9] Texas is expected to rank first in installed solar capacity growing 36,092 MW over the next five years.[10]

Figure 5. Impact of the Inflation Reduction Act on solar market outlook[11]



[8] https://www.seia.org/solar-industry-research-data
[9] https://www.seia.org/research-resources/impact-inflation-reduction-act
[10] https://www.seia.org/state-solar-policy/texas-solar
[11] https://www.seia.org/research-resources/impact-inflation-reduction-act

Perspectives from published studies

Research on the impact of utility-scale solar projects on surrounding property values is limited. Relevant published literature revealed the public, in general, supports the development of large-scale solar, yet when specific projects are proposed they are occasionally met with local opposition. Solar panels can affect the visual landscape and reflect sunlight.[12] Surveys responses have found that the visibility of a project and its size and/or installed capacity may affect public perception surrounding a proposed solar project.[13]

To determine if utility-scale solar projects have an impact on the value of surrounding real estate, the academic literature reviewed relies on statistical methods, such as regression analysis, to study relatively large groups of properties. Regression analysis is a common approach and can be useful in identifying and quantifying average effects across a study area. The average value estimated by a statistical model such as regression analysis does not represent an actual value of diminution for any individual property. Real estate is a highly individualized asset and as a result, effects from something such as utility-scale solar could vary across properties and property types, and at various distances or viewsheds. Although statistical methods are designed to identify and control for certain differences in property and sale characteristics, they are not capable of accounting for all the influences and nuances present in real estate markets and in individual transactions. The larger the geographic area and the wider the variation in property characteristics, the less representative an average effect will be of each individual home within the study area. For example, the average impacts derived from a study of newly constructed single-family residential properties in a five-mile radius of a solar project will yield more representative output than a study of residential properties located across an entire state. As a result, careful consideration must be given when considering the application and interpretation of the results from these models.

A search of academic journals revealed three published articles studying the impact of utility-scale solar projects on surrounding property values. A statistical study of the effect of both wind turbines and solar farms on house prices in the Netherlands was conducted in 2021 using a difference-in-differences approach in which the sales prices of houses near solar farms were compared to the sales prices of houses further away. The study examined 12,650 sales in the Netherlands from 2009 to 2019 surrounding 107 solar farms and concluded that solar farms can result in a decrease in house prices within 1 kilometer by an average of 2.6%.[14]

A recent study conducted by the Lawrence Berkeley National Lab also used a statistical difference-in-differences methodology to analyze 1.8 million residential transactions near over 1,500 large-scale photovoltaic projects (LSPVPs) in six states. The study concluded the effects of large-scale solar projects cannot be generalized, as any potential effects depend on many factors particular to

[12] M.I. Droes, H.R.A. Koster, "Wind turbines, solar farms, and house prices." *Energy Policy,* 2021: 1-11.
[13] P. Roddis, S. Carver, M. Dallimer, P. Norman, G. Ziv. "The role of community acceptance in planning outcomes for onshore wind and solar farms: An energy justice analysis," *Applied Energy*, 2018, 353-364, and J.E. Carlisle, D. Solan, S.L. Kane, J. Joe. "Utility-scale solar and public attitudes toward siting: A critical examination of proximity," *Land Use Policy,* 2016, 491-501.
[14] M.I. Droes, H.R.A. Koster, "Wind turbines, solar farms, and house prices." *Energy Policy,* 2021: 1-11.

individual projects or locations and found that these factors are not uniform across different projects or in different locations. Meaning a result found in one location cannot be applied or used to understand potential affects in another location. Three of the states studied showed no statistically significant impact from LSPVPs, while three states indicated a reduction in sale price for homes only within 0.5-mile of a LSPVP when compared to homes 2-4 miles away. Combining data from all six states yielded an average sale price reduction of 1.5% for homes within 0.5-mile of an LSPVP.[15]

A study published in 2023 used hedonic regression analysis to analyze the impact of solar projects on residential property prices in England and Wales and found an average 5.4% reduction in house prices for homes located less than 750 meters, or approximately 0.5-mile, from operational solar farms.[16]

Market trends analysis of specific utility-scale solar projects in Texas[17]

Six utility-scale solar projects in four Texas counties were identified for the purpose of analyzing and understanding potential effects of utility-scale solar projects on single-family residential property values. The market trend analysis tracks data on single-family residential real estate transactions involving properties in proximity to solar projects in Tom Green, Bell, Lamar, and Bee Counties. With sufficient data, this type of analysis helps us understand overall market patterns and correlates potentially shifting market conditions with specific points in time, such as the date of tax abatement approval for a utility-scale solar project or the date construction begins (an after period). Indicators of shifting market conditions include data on historical sales prices, the ratio between sale prices and listing prices, and changes in exposure time (i.e., the amount of time the

[15] For illustrative purposes, a 1.5% reduction of a $350,000 home would be $5,250 or yield a value of $344,750.
[16] D. Maddison, R. Ogier, A. Beltran. "The Disamenity Impact of Solar Farms: A Hedonic Analysis," *Land Economics*, 2023: 1-16.
[17] An analysis of market trends provides an overall picture of market activity. It is not sufficient to identify or quantify potential diminution in value at any one specific property or group of properties. Real estate is a unique asset and subject to individualized influences. Real estate markets, unlike the markets for other goods and services, have never been considered truly efficient because of the unique characteristics of each piece of real estate and the unique perceptions and level of knowledge of each buyer and seller (TARE, 15th edition, page 114). Market trends analyze overall patterns in a market, but these trends do not capture specific differences in property characteristics present at individual homes within each market, or unique sale conditions that may have impacted the sale price in certain transactions. While the trend analysis provides us insight on any potential market-wide effect, further analysis is required to identify and quantify diminution in value, if any, at the individual property level. TARE discusses the recognized and generally accepted specialized techniques used to identify and quantify diminution in value due to environmental contamination at the individual property level. These methodologies also apply when quantifying any impact to an individual property due to the presence of other types of potentially adverse influences, such as utility-scale solar, wind turbines, or high-voltage transmission lines. These recognized techniques include paired sales analysis, case study analysis, multiple regression analysis, and analysis of income and yield capitalization rates for income-producing properties (TARE, 15th edition, page 188).

property is on the market before it sells, "days on market"). The analysis performed here considers data on these three factors.[18]

For each solar project area identified, one or more control areas are identified to serve as baseline comparisons to identify any divergences in the two markets. Sales trends in the real estate market surrounding the utility-scale solar project, the "subject area," are compared to sales trends in a "control area" of generally similar properties located near but not proximate to the utility-scale solar project.[19] Ideally, the market data of a subject and control property will historically trend similarly. This allows us to consider the markets in the after period and identify if any divergences in the subject market trends exist. This could be in the form of the market demanding lower sales prices for adjacent or proximate properties, longer marketing time or days on market ("DOM"), or larger differences between the original listing price and the ultimate sales price. If a divergence is identified in the subject and control area data that correlates to pertinent dates associated with the utility-scale solar project (e.g., date of tax abatement approval, date construction begins), the divergence serves as an indicator of a potential market reaction to the presence of the utility-scale solar project. The presence of a divergence does not alone prove causation and requires more investigation to determine why it occurred. Real estate sale prices and other indicators are subject to normal market fluctuations and are influenced by several contributing factors. Although a market trend analysis tracks market metrics and identifies shifting market patterns correlated with the date of a specific activity (e.g., the construction of a proximate utility-scale solar facility), the analysis does not sufficiently identify the causality of any such market shift. The identification of a dip or divergence requires additional research to determine the cause of the market shift. Additional research may include interviews with market participants and paired sales analyses of individual sales.

The study areas considered in this research were selected with key real estate market features in mind. Project location in an area of competing land use was a key criterion. Projects located near and amongst residential properties or where land use is being converted from an alternative use are most likely to see an effect if one exists. For example, many solar projects have been developed in West Texas surrounded by vacant land or land with similar industrial uses such as oil and gas production or agricultural use. These projects are also often located miles from residential homes. As the land use of these properties is consistent or not conflicting with surrounding land use, one can logically presume proximate land values are likely to be unaffected. As a result, the analysis here focuses on projects where the surrounding areas have contrasting land use types or where land use has been converted for the project (i.e., solar acreage previously used as rural residential). [20] Projects of significant size, 100 MW or greater, were also selected as these have the most significant potential viewshed impacts and drastically alter an areas landscape.

[18] TARE, 15th edition, page 389.
[19] Identifying control properties near subject properties helps alleviate the potential for locational market differences that could preclude comparability.
[20] This is consistent with the body of literature reviewed stating any potential impact on the value of surrounding real estate would be expected to be highest in areas with residential development.

Furthermore, rural and urban residential markets are unique, with different market participants and different value considerations.[21] To understand how a utility-scale solar project may affect each market, projects located both in rural and urban areas, and in various geographic locations throughout the state of Texas, were considered. For example, projects near planned developments (smaller tract properties with homogenous builder(s) and floor plans) are considered as well as projects near more rural residential properties (larger tract properties with unique builders and property features). The varying projects chosen help us to understand how the perceptions of these different market participants, and their unique perceptions, may impact the sales of residential properties near a utility-scale solar projects.

Solar projects that are either operational or under development/ construction are considered in this research. Markets surrounding projects in these stages are most likely to have full knowledge of the projects. Projects only in the planning phase also have the potential to not come to fruition, and many in the market may be unaware of a project's potential. Therefore, the information about a potential project may not have fully saturated the market. Markets may also react differently during the construction phase and the operational stages, therefore considering projects at each stage was important.

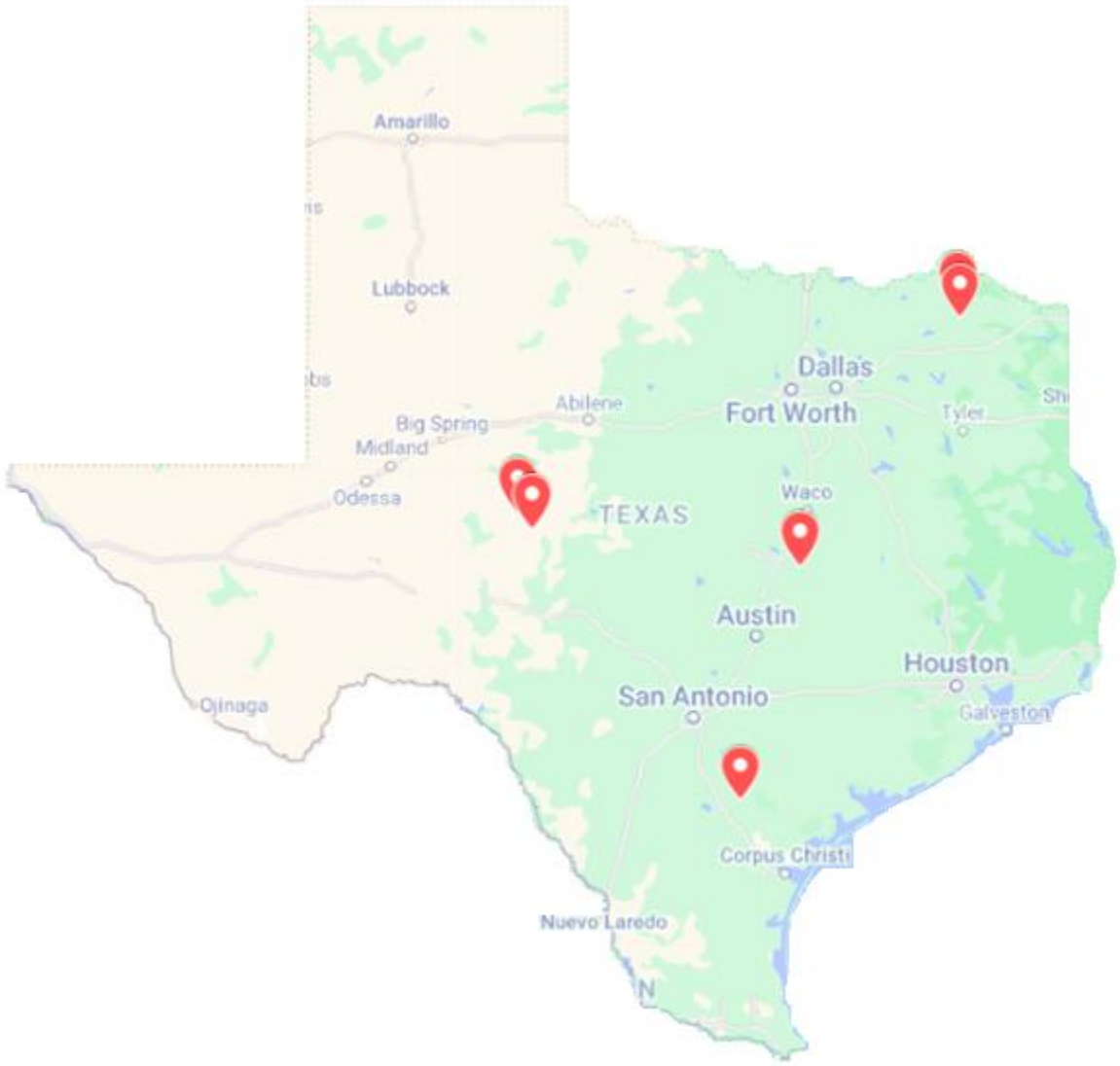
Operational or projects under development, with a capacity of 100 MW or greater, surrounded by a sufficient number of residential properties, and located both in rural and urban areas were considered for this research. Six utility-scale solar projects in four Texas counties were identified fulfilling the market and locational characteristic requirements discussed. Market trends analysis was performed for these six projects.

Table 1. List of solar projects considered by county

Tom Green County	Bell County	Lamar County	Bee County
Rambler Solar Concho Valley Solar	Five Wells Solar	Impact Solar Samson Solar	Sparta Solar

[21] For this reason, in a sales comparison analysis, it would be inappropriate to use a property located in an urban center as a comparable sale to a property located in a remote rural location.

Figure 6. Map of utility scale solar projects considered in the analysis



Tom Green County – Rambler Solar and Concho Valley Solar

Two utility-scale solar projects in Tom Green County, located on the Edwards Plateau in West Texas, were analyzed for the purpose of identifying market impacts to single-family residential homes located proximate to these projects. These two projects, Rambler Solar and Concho Valley Solar, were chosen due to their location near the county seat of San Angelo and proximity to residential developments.

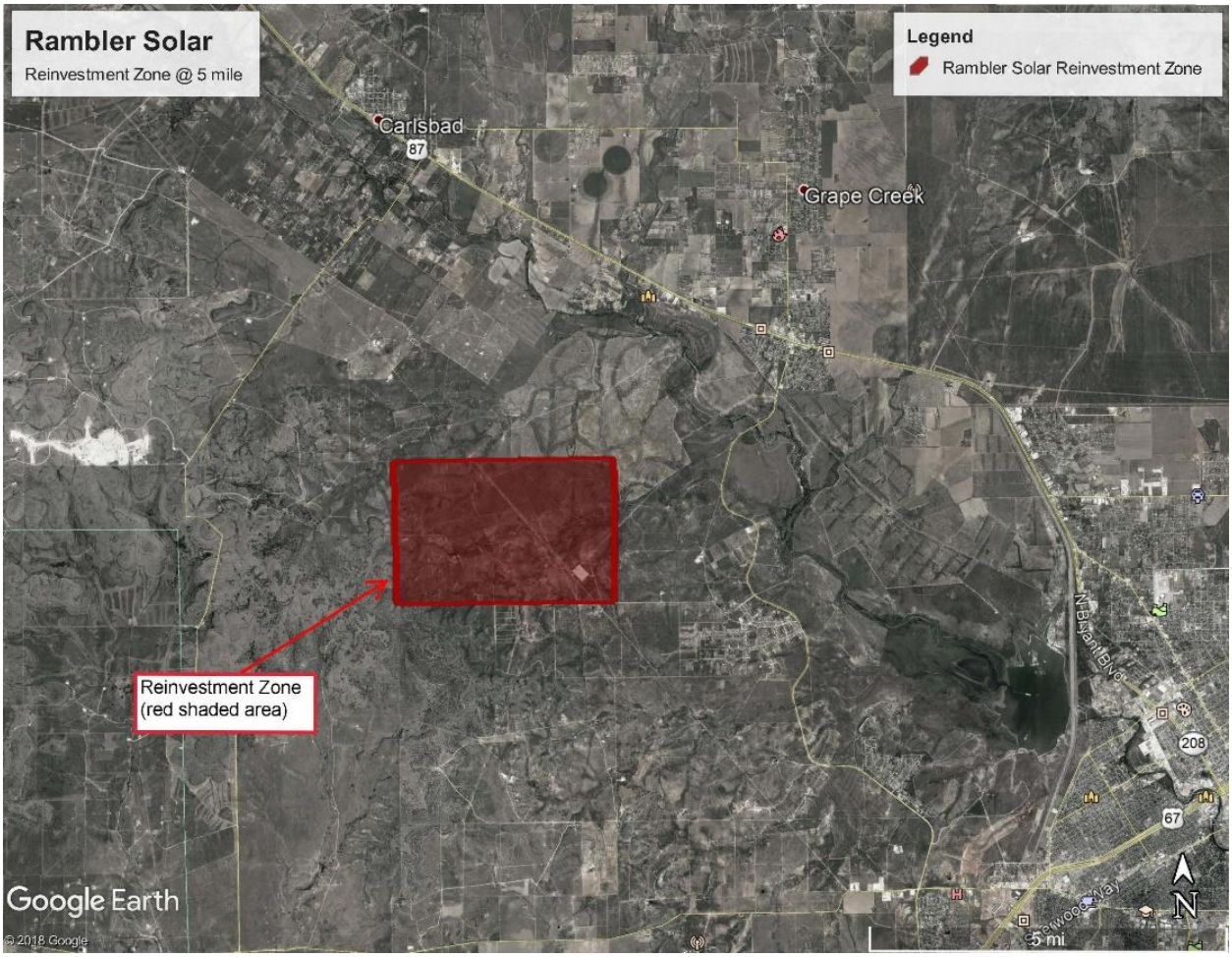
Rambler Solar

Rambler Solar is a 200 MW solar facility located at 8999 Jeremiah Lane, northwest of San Angelo. The facility spans approximately 1,700 acres and contains over 733,000 high-efficiency solar panels (bifacial models). The Rambler Solar facility can power approximately the equivalent of 40,000 homes when operating at full capacity. It was the first solar project in Tom Green County and Duke Energy Renewables' fourth solar generation facility in Texas. A tax abatement application was submitted in January 2019 for the project. Duke Energy acquired the Rambler Solar project from Recurrent Energy in September 2019, and commercial operation began in July 2020.

Figure 7. Aerial photo of Rambler Solar Project[22]

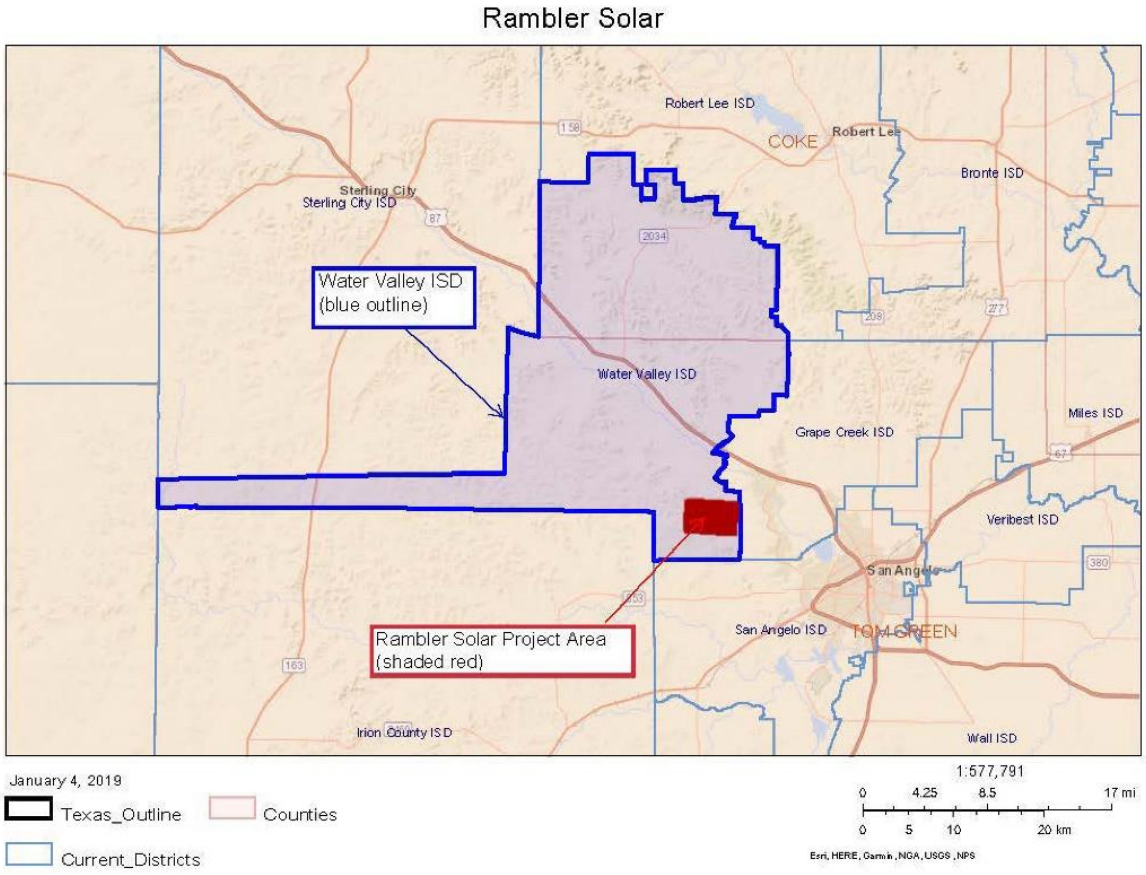
[22] Photo by Duke Energy

Figure 8. Aerial Map depicting the location of Rambler Solar Reinvestment Zone[23]



[23] Figure taken from the Application for Appraised Value Limitation to Water Valley Independent School District.

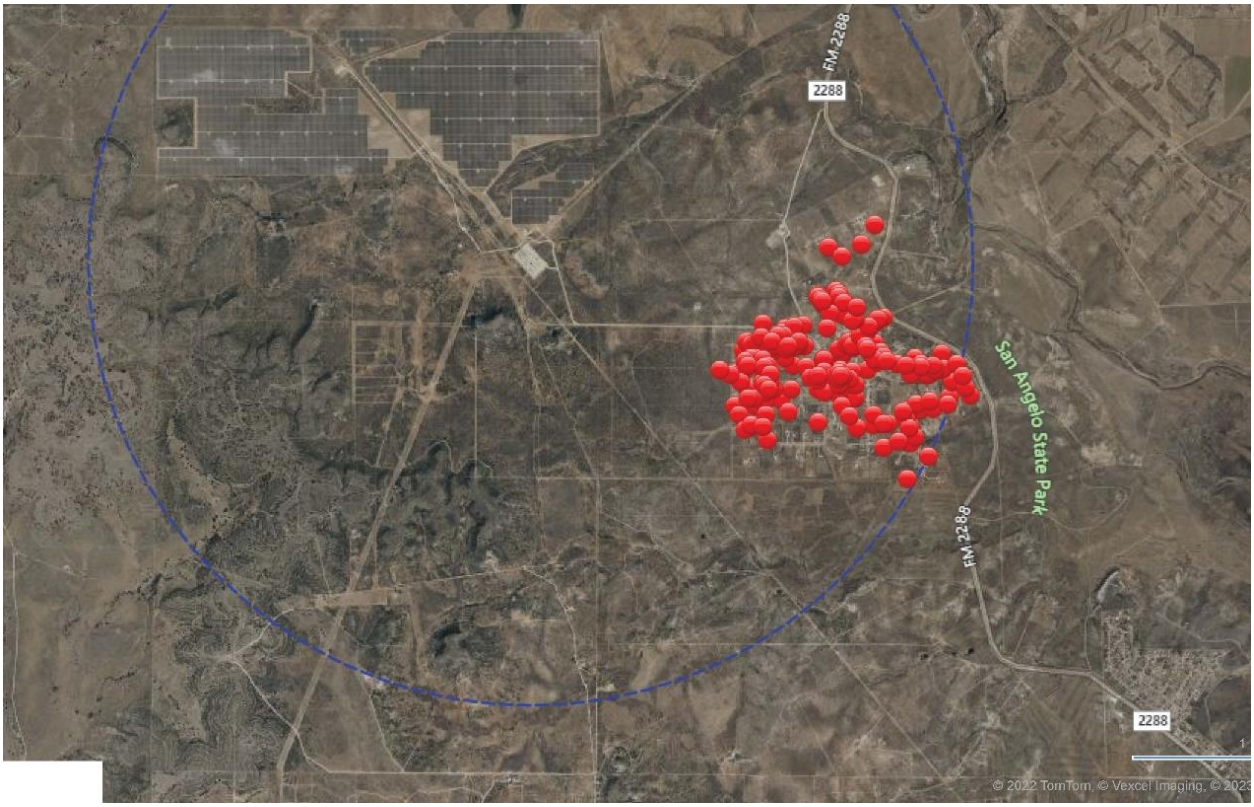
Figure 9. Location of Rambler Solar Project and Water Valley Independent School District[24]



Buffalo Heights, located approximately 1.5 miles to the southeast of Rambler Solar, is the closest residential development. The planned residential community, first developed in 2008, is located about ten miles northwest of San Angelo. These homes, built from 2009 to the present, have relatively large lot sizes (on average one acre) and range in size from approximately 1,400 to 3,500 square feet. Data was pulled on sales within a three-mile radius of the entrance to the Rambler Solar facility. As can be seen in Figure 9 below, the majority of these sales are located within the Buffalo Heights development.

[24] Figure taken from the Application for Appraised Value Limitation to Water Valley Independent School District.

Figure 10. Sales from July 2020 to March 2023 within a three-mile radius of the Rambler Solar facility entrance



For the purpose of comparison, several control communities were selected. These communities are single-family residential developments similar to Buffalo Heights but not located in proximity to a utility-scale solar project.[25] Data was collected on control area sales in the area south of San Angelo and north of Christoval (including the residential developments Oak Mountain Estates, The Haciendas at Christoval, Stonewall Reserve, and Pecan Creek), as well as the area north of Wall and to the east of San Angelo (including the residential developments Iron Horse and Stonewall Range). These areas were selected based on their general similarity to the subject sales in Buffalo Heights; specifically, larger lot sizes, a majority of homes with relatively newer construction (post-2000), and similar approximate distance to the city of San Angelo. Data on all sales transacting through the Navica Multiple Listing Service ("MLS") from January 2016 through March 2023, was collected for purposes of analysis.[26]

[25] Residential developments with similar property characteristics were selected for use as control areas. Homes with different characteristics (e.g., homes on smaller lots within the city of San Angelo or older homes) may be impacted differently by changes in economic conditions. Therefore, the selection of control areas with similar characteristics is imperative for truly identifying a benchmark than considering citywide or countywide averages.
[26] Because we are using the MLS, not all sales occurring in the areas are necessarily being captured and therefore, this is a representative sample.

Data on the median price per interior square foot of living space, sale to list price ratio, and DOM was obtained for the subject and control area sales. If the announcement or construction of the Rambler Solar project had a negative impact on sales prices in the surrounding market area, the graph would show a dip or divergence in sales price per interior square foot in the subject area compared to the control areas and correlate with relevant project dates (i.e., the date the project was announced, or the date of construction). If a dip or divergence is evident at a different point in time (not correlated with the project under study), it is unlikely to be associated with the solar project. Similarly, an impact for the other metrics would be in the form of a lower sale to list price ratio (i.e., the sale price of properties sells lower compared to the list price) or the average DOM increases following the key dates.

Figure 10 depicts the median price per interior square foot in both the subject area and the identified control areas. The price per interior square foot of living space rose in a general trend over time for both subject and control area properties. Median price per interior square foot in the identified control areas is higher than the price per interior square foot in the subject area, both before and after the construction of the Rambler Solar facility. This is likely due to the newer construction in the control areas that has come available in recent years. The control area median price per interior square foot began to rise relative to subject area prices in 2017. The positive divergence in the control areas continued until 2019. Key dates to consider are Rambler Solar's tax abatement application in January 2019, and the publicity surrounding the project's purchase by Duke Energy in September 2019. During this 2019-time frame, median prices leveled out in the control areas while prices in the subject area near Rambler Solar continued to rise, narrowing the price gap between the two areas. The prices in both areas trended generally together throughout 2020, the year Rambler Solar began operations. In 2022, control area prices grew at a faster rate which is consistent with the number of new construction homes coming available in the control areas. New construction often brings a higher price per interior square foot than the price per interior square foot of relatively older homes.

Figure 11. Median price per interior square foot for the subject and control areas for Rambler Solar

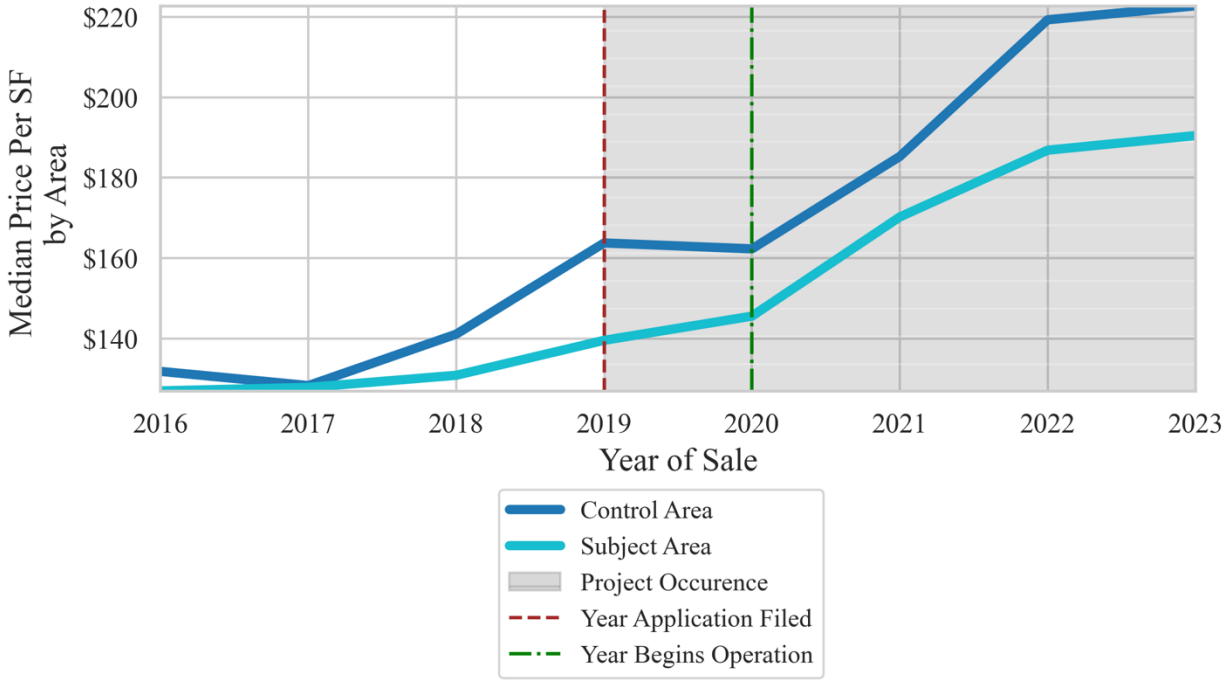


Figure 11 graphs DOM and shows similar trends for both proximate and distant homes, providing no indication of market resistance. Figure 12 graphs the sale to list price ratio. Sales proximate to Rambler Solar tend to sell consistently at full asking price, particularly in more recent years. This contrasts with homes further away, which often sell at a discount relative to their original listing price.

Figure 12. Days on market for the subject and control areas for Rambler Solar

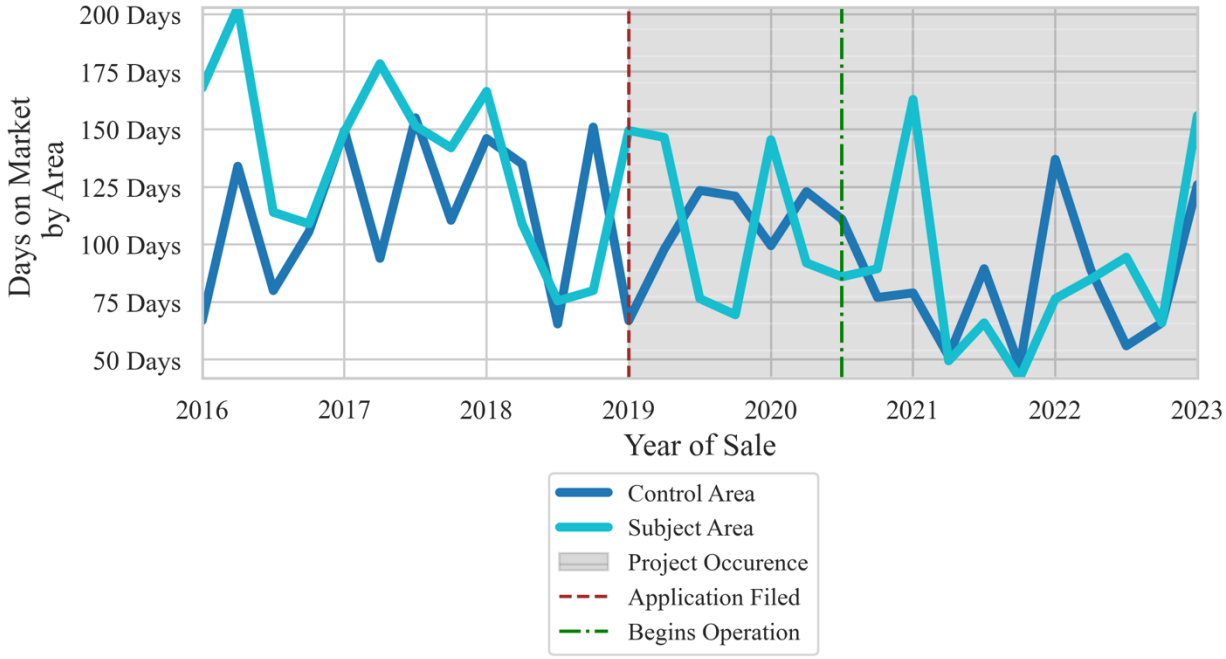
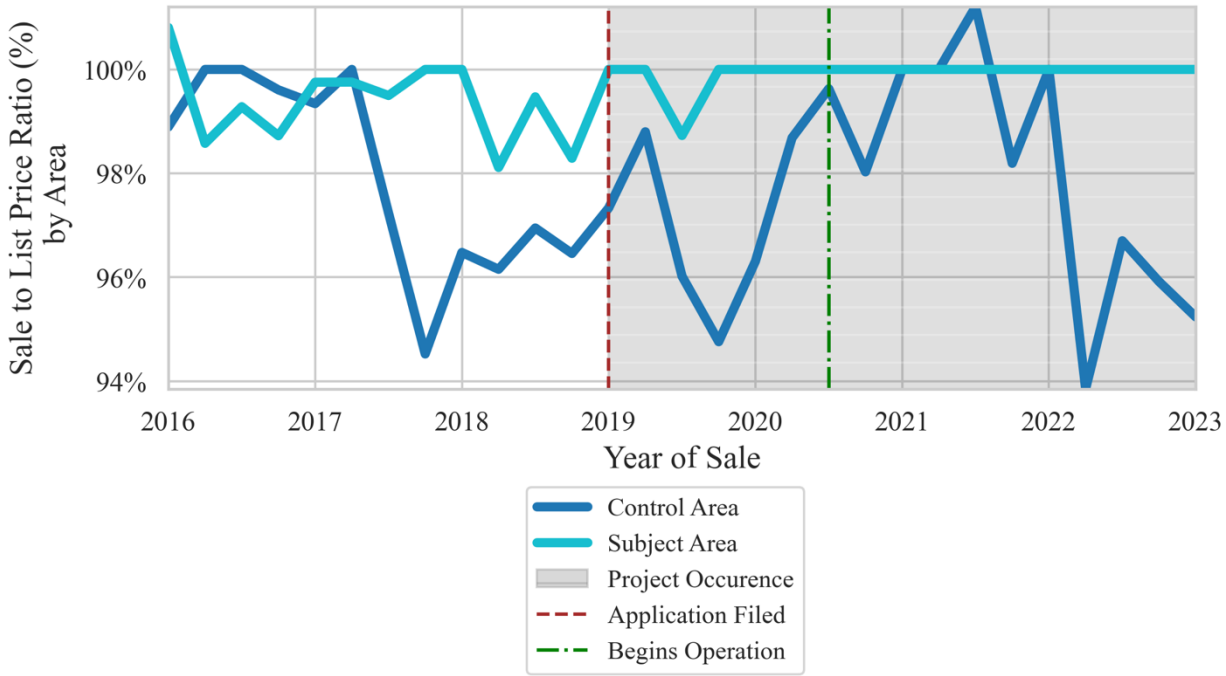


Figure 13. Sale to list price ratio for the subject and control areas for Rambler Solar

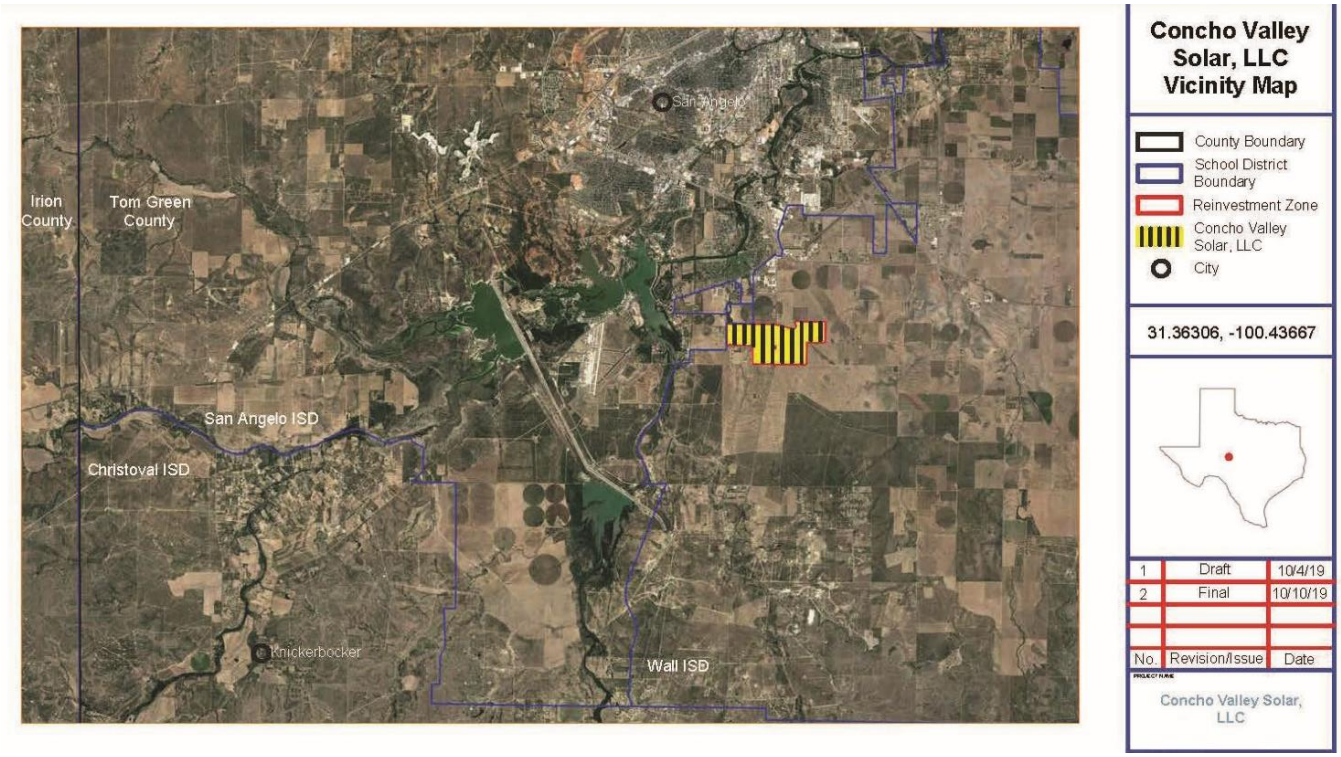


These market trends do not show any evidence of negative impact correlated with the announcement or construction of the Rambler Solar facility. To the contrary, median price per interior square foot improved in the 2019-2020 time frame relative to control area prices, as the Rambler Solar project was announced and constructed. Subject area sales near Rambler Solar sell at a higher sale to list price ratio on average, and the days on market have fluctuated over time but are generally consistent with the marketing time for control area homes. It should be noted that the subject area homes in Buffalo Heights do not have a view of the Rambler Solar project. These results are consistent with literature which has noted that property value impacts are most likely for residential properties with a view of a utility-scale solar project, versus residential properties in proximity to a solar project but without a direct view.

Concho Valley Solar

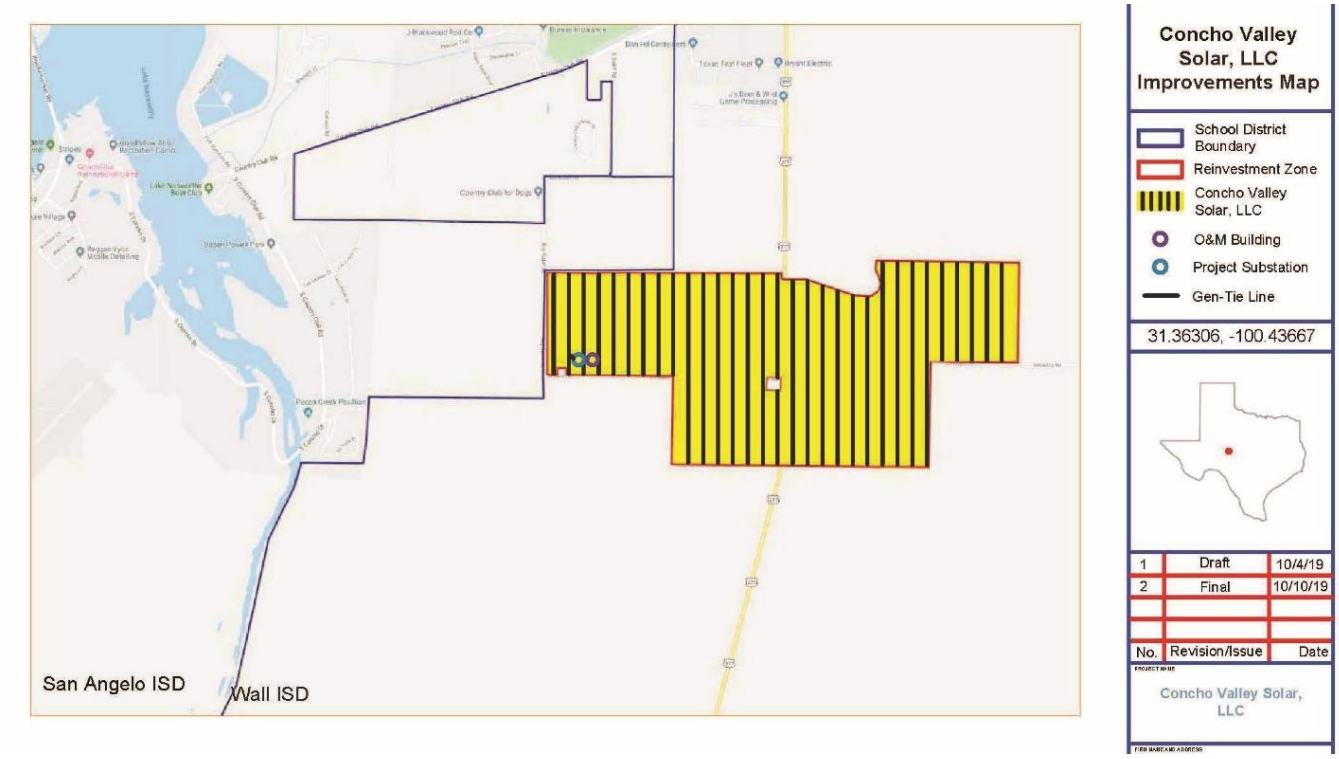
The Concho Valley Solar project is located approximately 1.5 miles to the southeast of residential development in San Angelo. Some rural homes are located in closer proximity to Concho Valley Solar. The 159.8 MW project, with an address of 467 Ratliff Drive, consists of approximately 700 acres of land. It is the second completed solar project in the county. An application for tax abatement was received in November 2019, construction began in November 2021, and it became operational in December 2022.

Figure 14. Aerial map depicting the location of Concho Valley Solar project[27]



[27] Figure taken from the Application for Appraised Value Limitation to Wall Independent School District

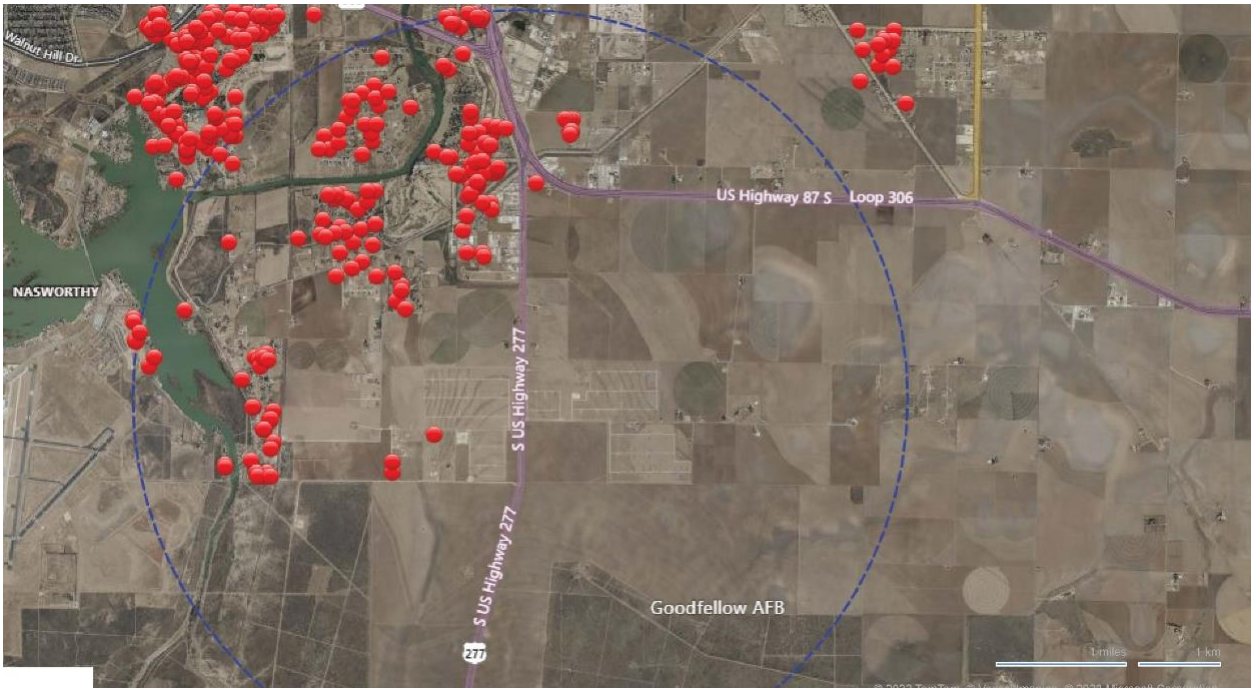
Figure 15. Location of Concho Valley Solar project and San Angelo Independent School District[28]



Data was collected on subject area residential sales from January 2016 to the present within three miles of the Concho Valley Solar facility, south of the Concho River and Highway 87 N, which serve as a physical barrier separating properties north of the solar project.[29] These sales are located primarily in two designated neighborhoods in San Angelo— the Country Club neighborhood and the Nasworthy neighborhood.

[28] Figure taken from the Application for Appraised Value Limitation to Wall Independent School District
[29] A physical barrier acts as a feature that physically separates areas and as a result, creates differing experiences for property owners across such divides.

Figure 16. Sales from January 2016 to March 2023 within a three-mile radius around Concho Valley Solar facility



These are designated as Neighborhood 22 and Neighborhood 23 on the map in Figure 16 below from the Development Services Department in San Angelo. For the purpose of this analysis, sales in these same neighborhoods but north of the Concho River and Highway 87, and sales west of Lake Nasworthy, were selected as control areas. These sales are in the same general neighborhood as the subject sales but physically separated from the Concho Valley Solar facility by water or a major highway.

Figure 17. San Angelo neighborhood map[30]

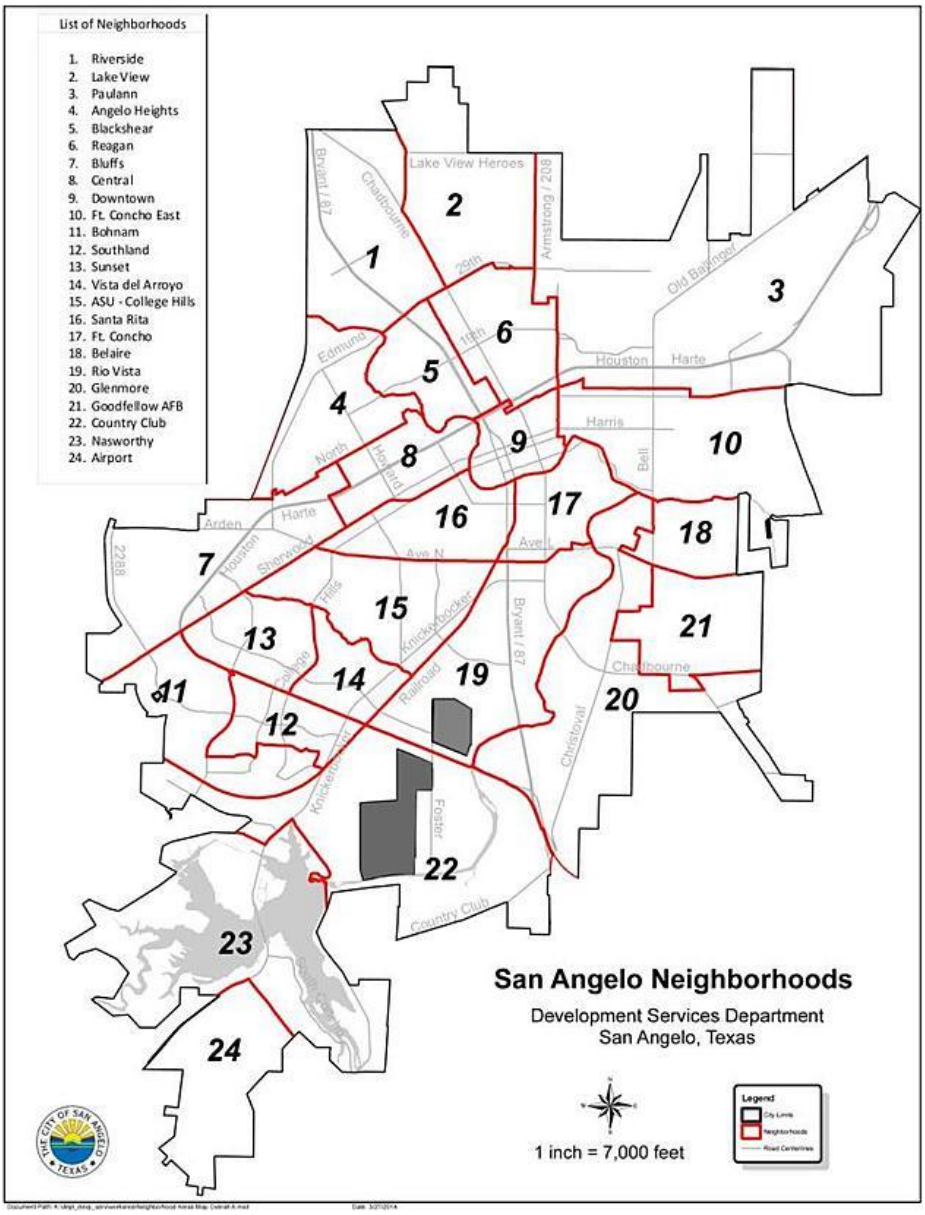
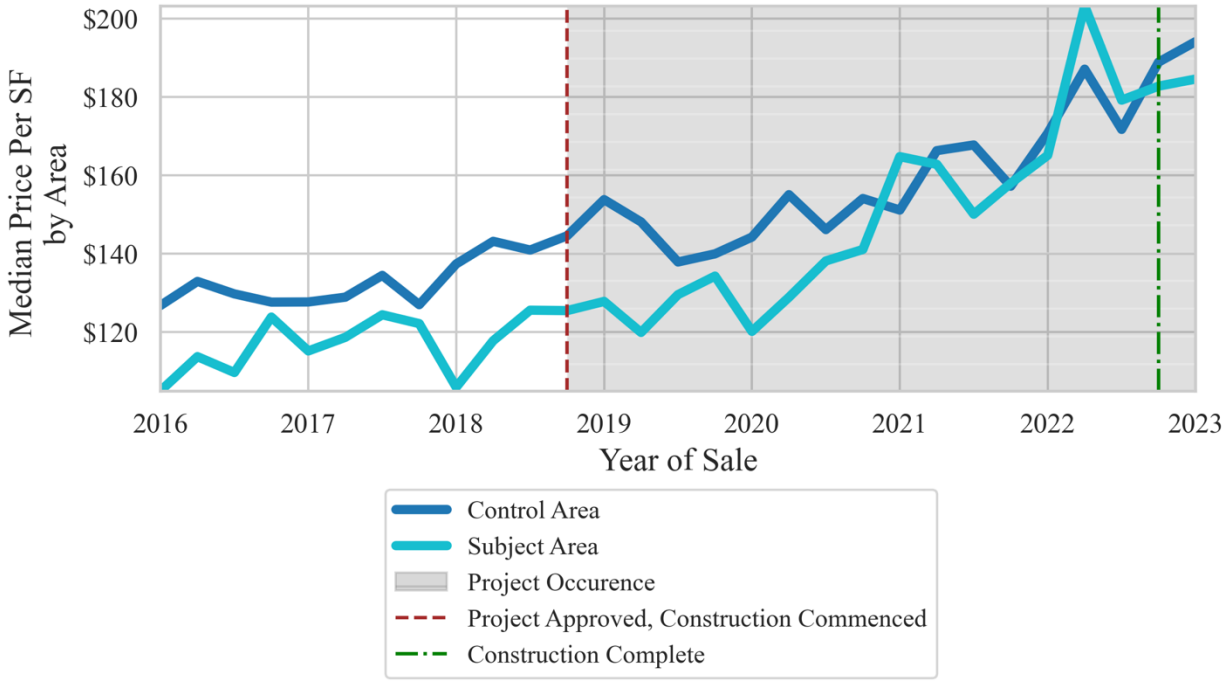


Figure 17 graphs median price per interior square foot for the subject and control areas and indicate the prices of properties close to the Concho Valley Solar project converged with, and occasionally outpaced, properties further away. This trend was present in more recent years, during the construction and completion of the project.

[30] San Angelo Development Services Department

Figure 18. Median price per interior square foot for the subject and control areas for Concho Valley Solar



DOM were generally similar or slightly lower (meaning quicker to sell) than homes further away. This was a difference that both predated and continued after the announcement and construction of the Concho Valley Solar project. Sale to list price ratios also trended closely with homes further away both during and after announcement and construction phases of the project, with no discernable divergence occurring in the data.

Figure 19. Days on market for the subject and control areas for Concho Valley Solar

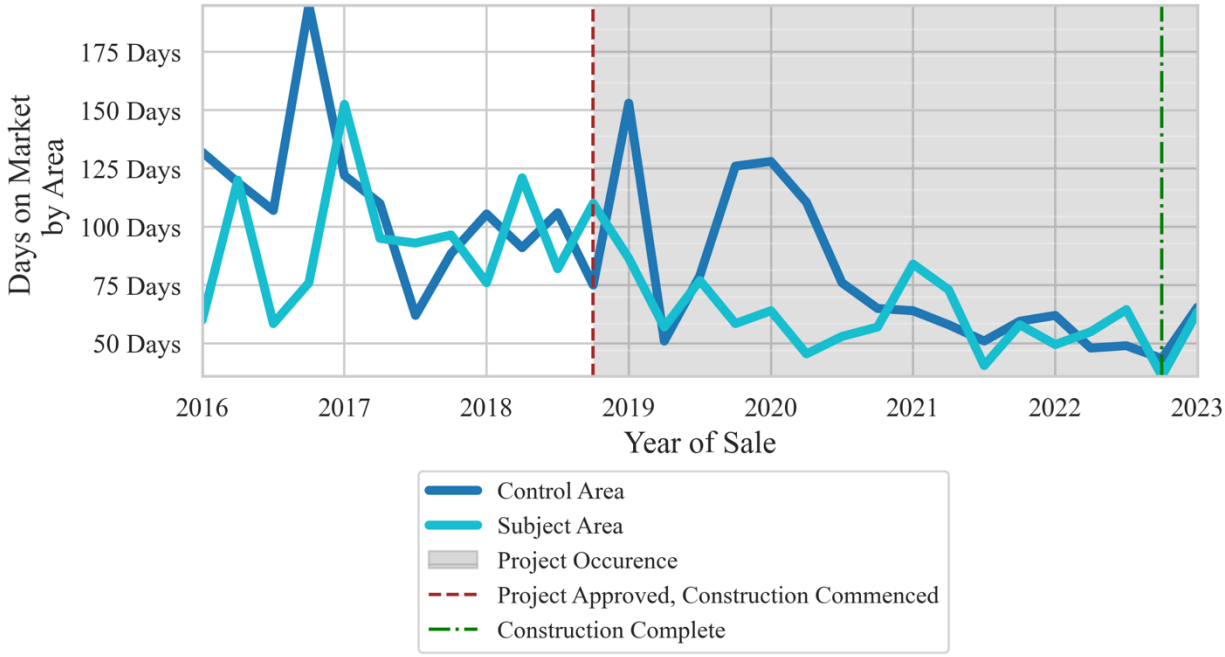


Figure 20. Sale to list price ratio for the subject and control areas for Concho Valley Solar

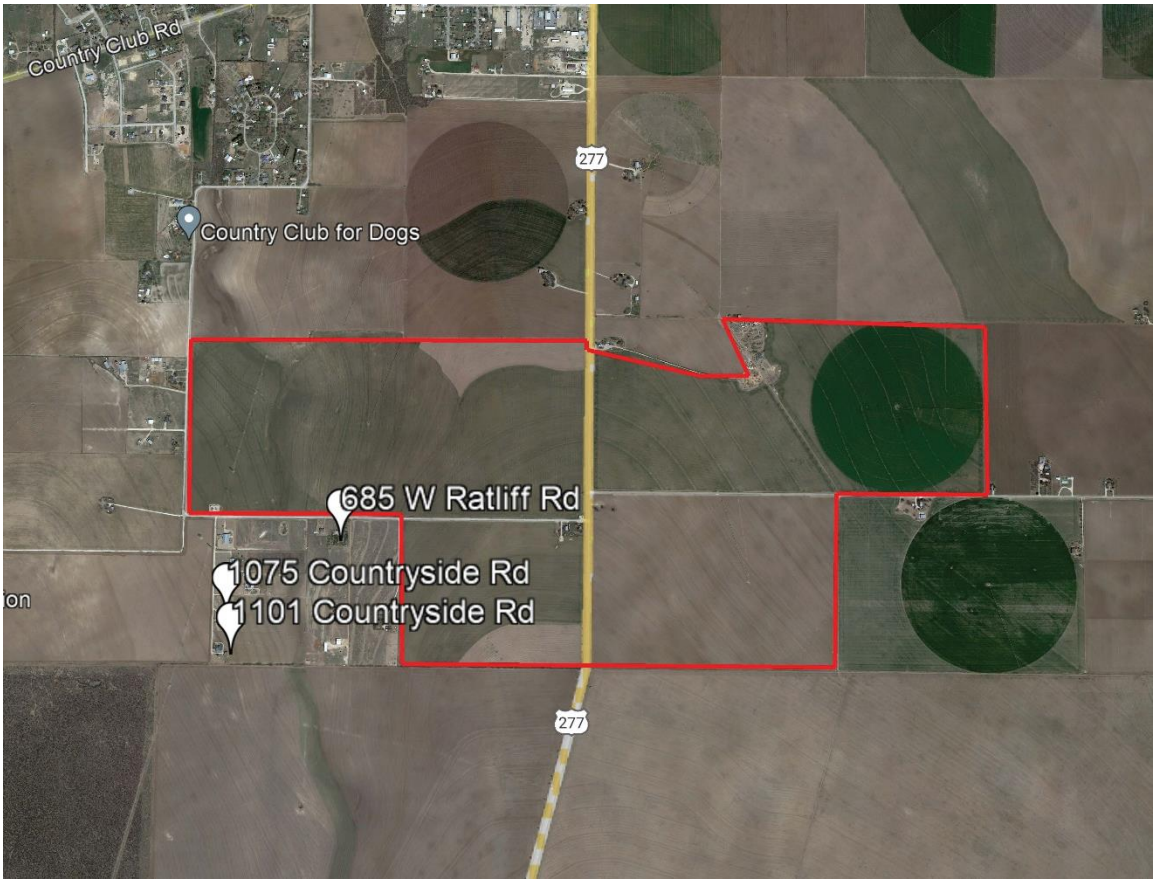
These trends show no evidence of market impact to homes within three miles of the Concho Valley Solar facility and south of the Concho River and Highway 87 N. To the contrary, subject area sales prices have improved relative to the control area sales since 2020, the years following the announcement and construction of the Concho Valley Solar facility. Both sales to list price ratios and DOM have generally trended with that of control area properties throughout the time period studied, both before and after the announcement and construction of the Concho Valley Solar facility.

Similar to the residential sales surrounding the Rambler Solar project, the majority of subject area sales in this analysis do not have a direct view of the Concho Valley Solar facility. However, three rural residential sales have occurred since the announcement of the project that were either adjacent to the facility or have a direct view of the facility.

Three individual sales were considered in more detail due to their proximity to or view of the Concho Valley Solar project. A single-family residential home on Ratliff Road, adjacent to the project, sold on March 8, 2021, for $709,000. The sale occurred after the Concho Valley Solar project announcement and tax abatement approval, but before construction of the project began. The seller was also the listing agent. While confirming the marketing period of the transaction, the seller did not indicate that the project had an effect on the property.[31] Two homes sold on Countryside Road, in close proximity to Concho Valley Solar, in 2022, after construction of the project was underway. A single-family home on Countryside Road sold on July 1, 2022, for $900,000. A high-voltage transmission line is also visible from this property. The listing agent stated the 71 DOM was faster than the typical DOM for homes selling in the $900,000 range which was closer to 150 days. The agent stated the property actually sold closer to the date it was listed but the longer closing period was due to the buyer having a contingency to sell their other property. When asked about the Concho Valley Solar projects the agent stated they had not found that the project has affected the sales they have been a party to nor have buyers shown concern.[32] The other property on Countryside Road sold on September 14, 2022, for its full listing price of $565,000. The sale was confirmed with the agent, who said that while some buyers had questions about the Concho Valley Solar project, it ultimately did not impact the sale price.[33] The buyers paid full price for this property.

[31] Conversation with agent involved with the sale on 5/30/2023.
[32] Conversation with agent involved with the sale on 5/30/2023.
[33] Conversation with agent involved with the sale on 3/5/2023.

Figure 21. Map of Individual Sales Near Concho Valley Solar[34]

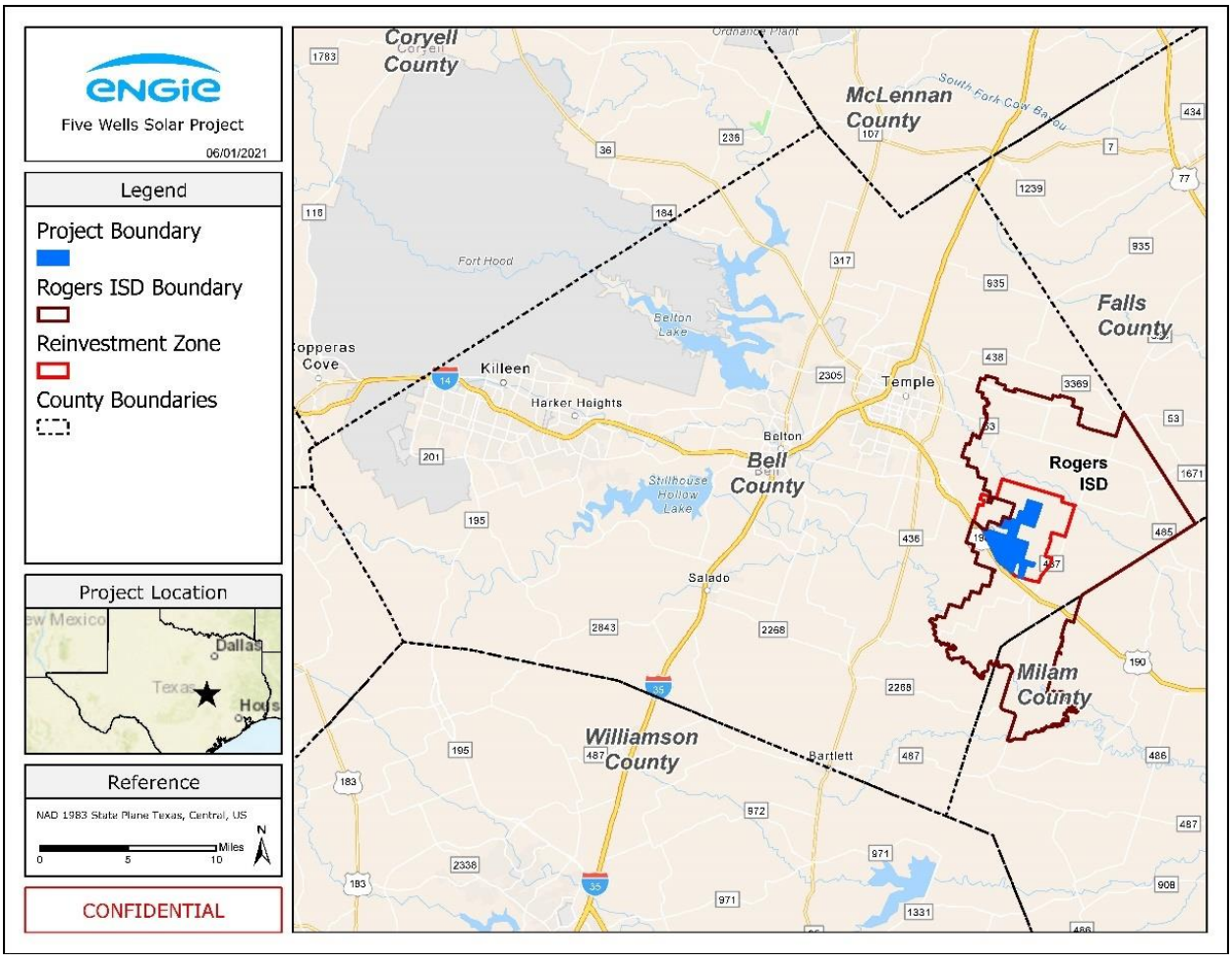


[34] This aerial was as of March 2021, prior to construction of the Concho Valley Solar project. The approximate boundary of the solar project is outlined in red.

Bell County – Five Wells Solar

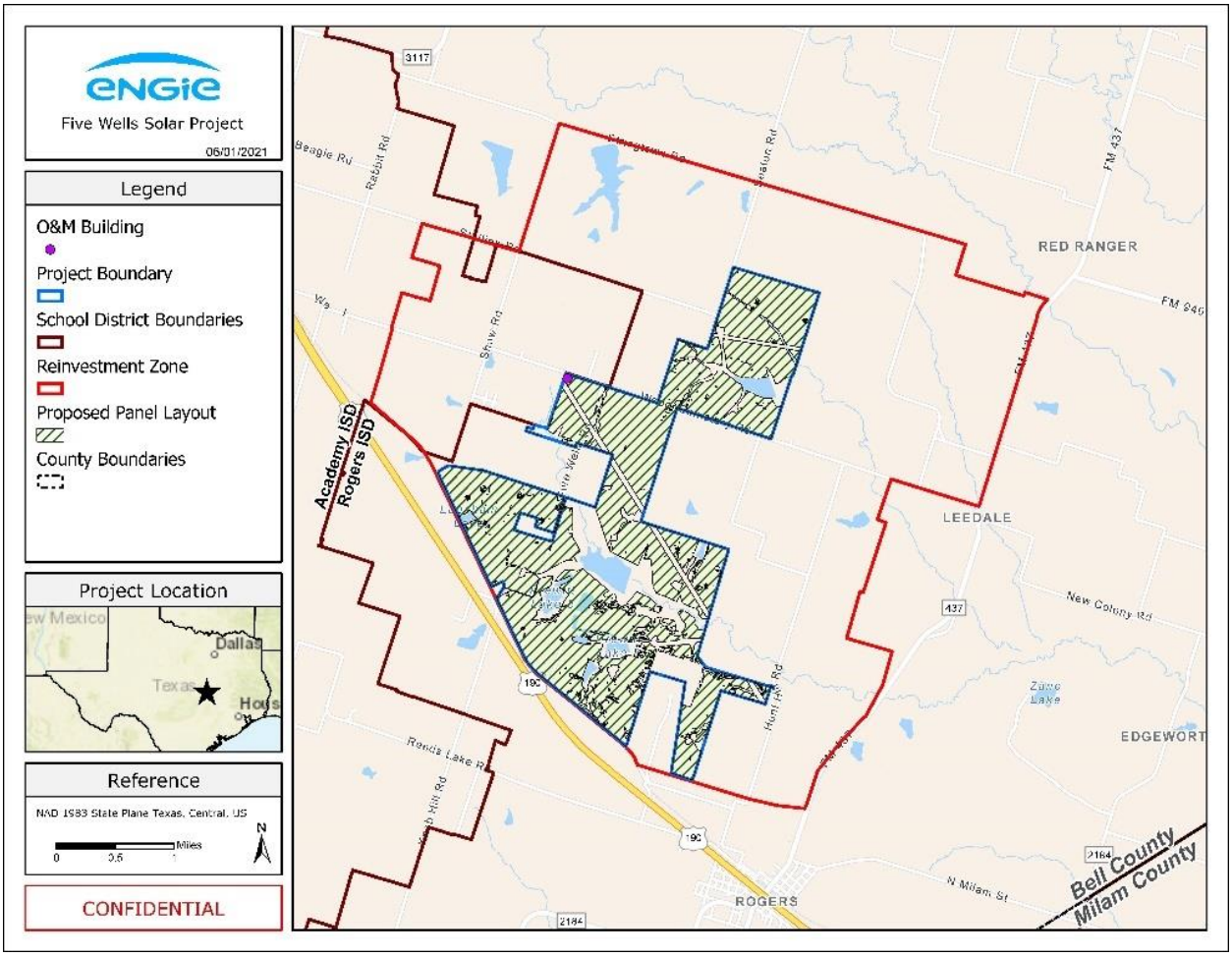
Several utility-scale solar projects are being approved and constructed in Bell County, located in Central Texas along Interstate 35 between Austin and Waco. The first of these projects, the Five Wells Solar project, is located east of Temple along Highway 190 near the town of Rogers. The application for tax abatement for Five Wells Solar was submitted in July 2021 and approved in May 2022. Construction of the project began in late 2022 and is currently underway. Five Wells Solar comprises approximately 8,000 acres and will have a solar production capacity of 350 MW.

Figure 22. Map of Five Wells Solar project and Rogers Independent School District in Bell County[35]



[35] Figure taken from the Application for Appraised Value Limitation to Rogers Independent School District

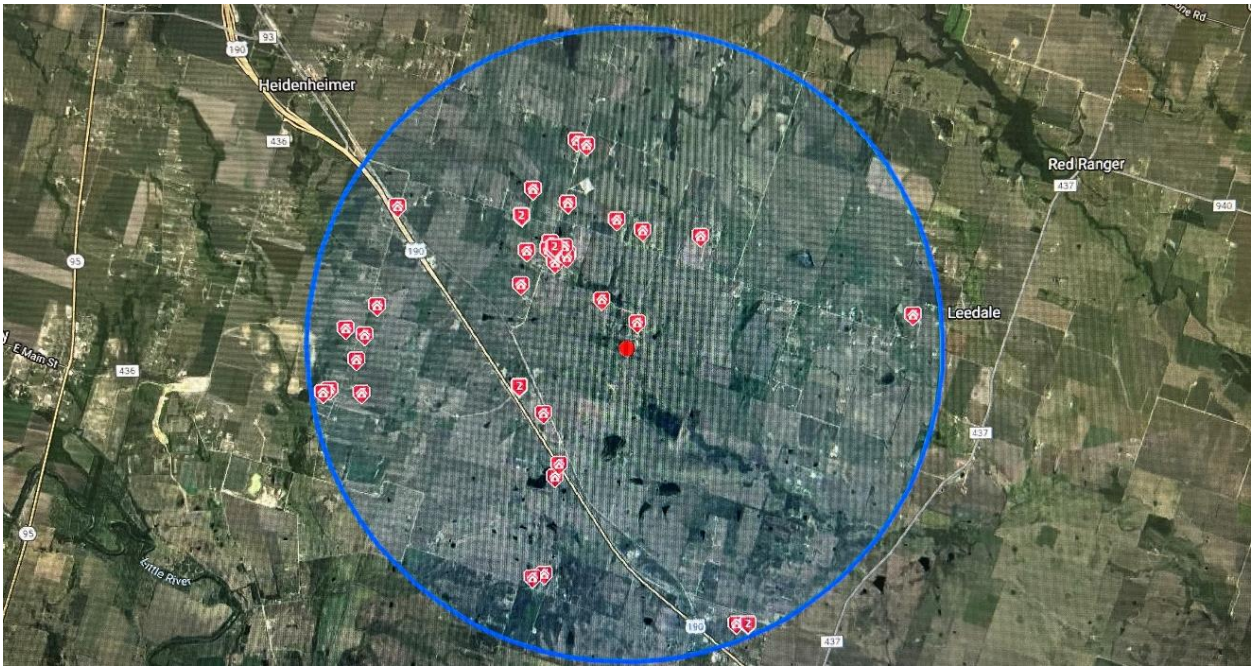
Figure 23. Map of Five Wells Solar project[36]



The residential development in this area is more rural in nature, compared to the planned developments residential neighborhoods analyzed in Tom Green County. These tracts primarily consist of rural residential homes on small acreage lots. The large size of the solar project, combined with the sloping topography in the area, result in a greater number of proximate homes to have a view of the Five Wells Solar facility. For purposes of this analysis, residential sales within a three-mile radius of the address point of the Five Wells Solar facility at 9161 Five Wells Road, Rogers, Texas, were analyzed as subject sales. All Bell County residential sales outside of the three-mile radius but east of Highway 95 and Interstate 35 were designated control area sales. Both the subject and control area sales are primarily rural residential properties located in eastern Bell County with similar locational influences and market appeal.

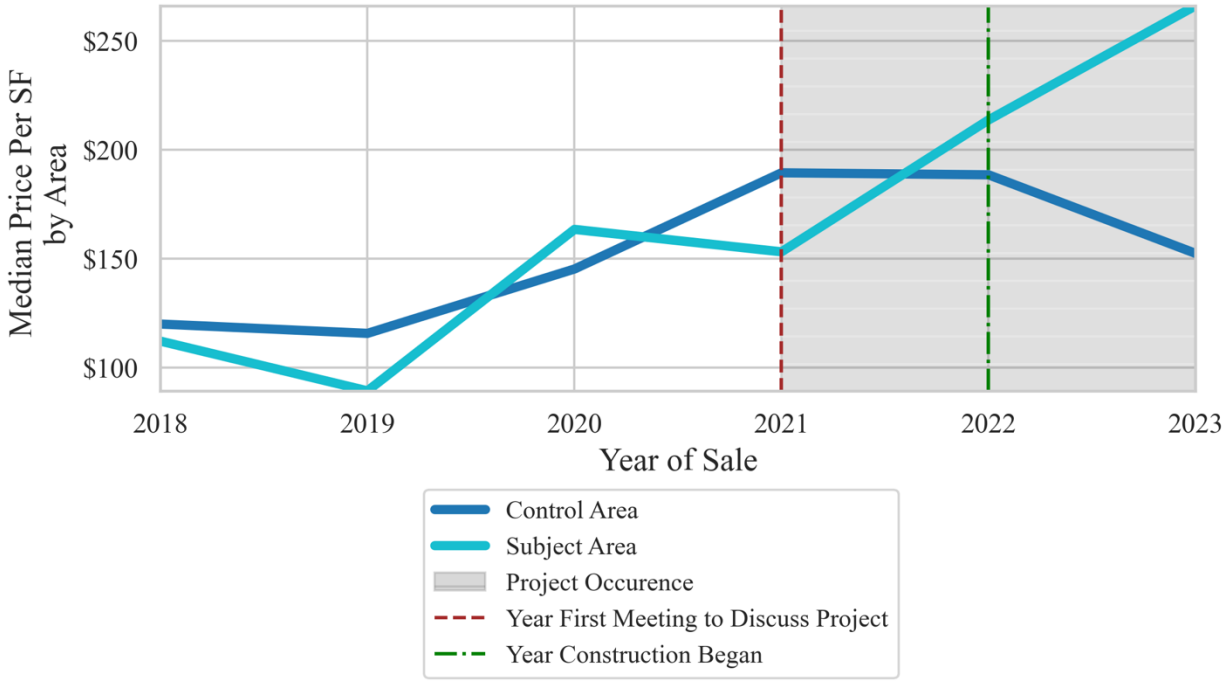
[36] Figure taken from the Application for Appraised Value Limitation to Rogers Independent School District

Figure 24. Sales from January 2018 to March 2023 within a three-mile radius around Five Wells Solar facility



In recent months, after the approval of the tax abatement and during construction of the Five Wells Solar project, median price per interior square foot for homes near Five Wells Solar have increased significantly compared to homes farther away. Before the project was announced or construction started, prices in the area were generally lower relative to prices of homes further away. This reversed within a year of the project's announcement.

Figure 25. Median price per interior square foot for the subject and control areas for Five Wells Solar



Median price per interior square foot of homes proximate to the Five Wells Solar project tend to sell for higher sale to list price ratios (meaning fewer to no discounts, or in recent years, selling above the asking price). Proximate properties did appear to take longer to sell, with longer median days on market, though this was true in some years prior to the pandemic. To better understand the cause of these longer marketing periods, realtors involved in several subject area transactions were interviewed.

Figure 26. Days on market for the subject and control areas for Five Wells Solar

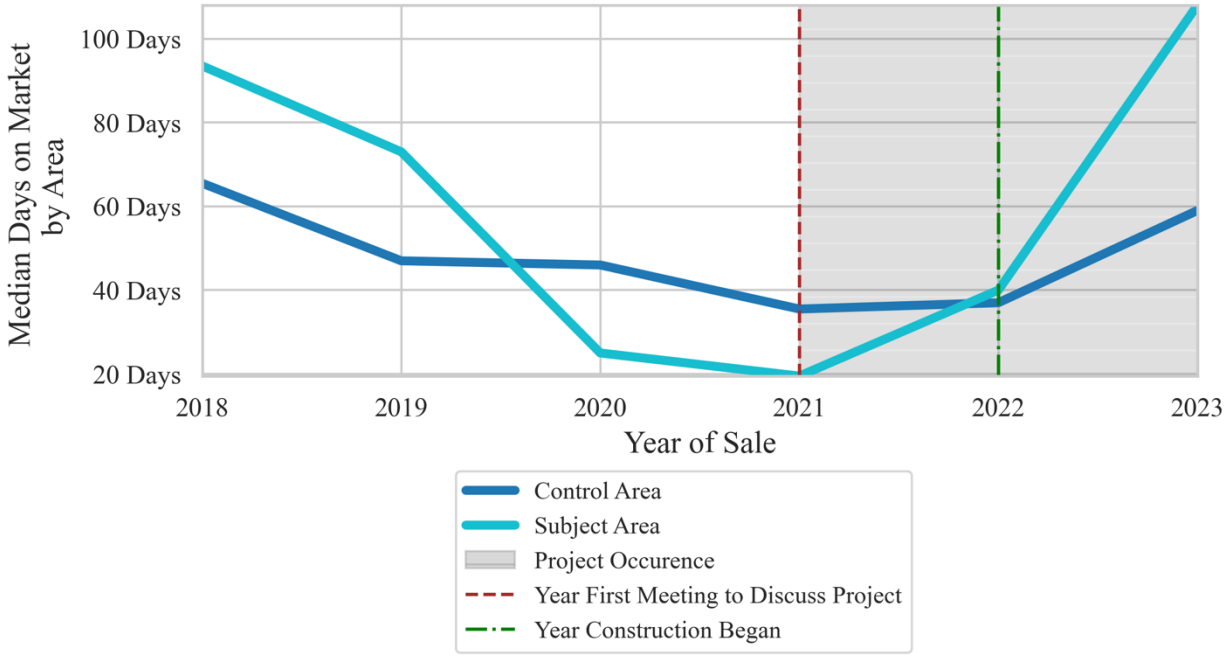
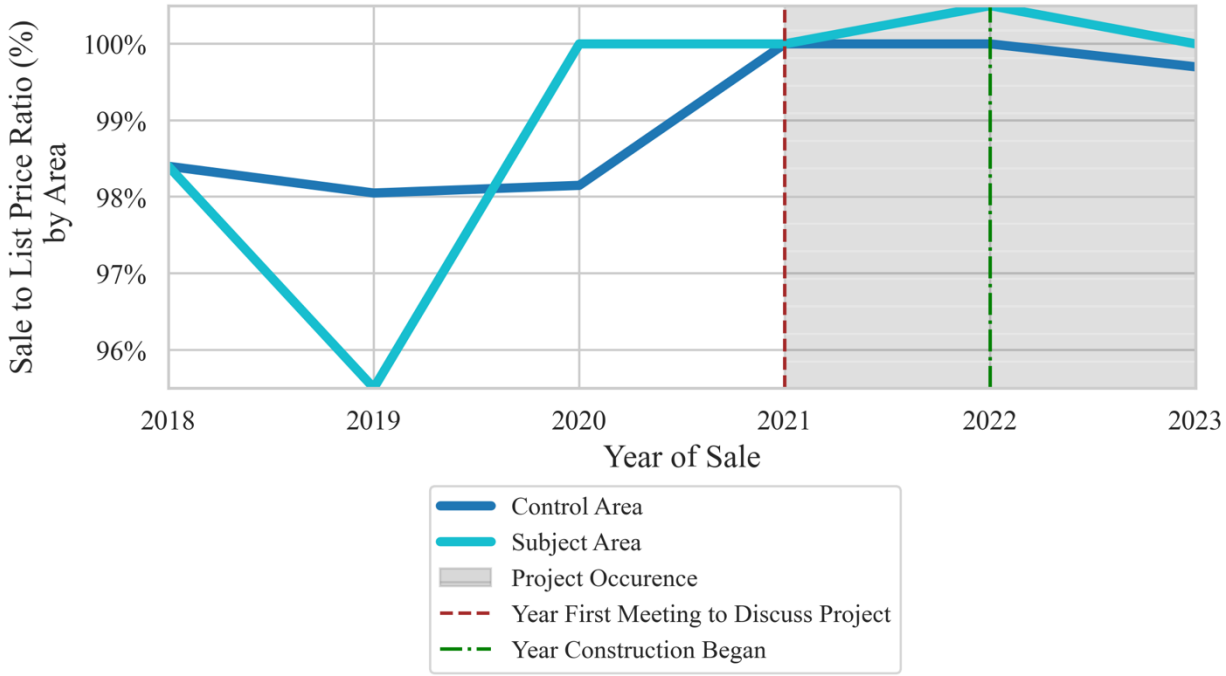


Figure 27. Sale to list price ratio for the subject and control areas for Five Wells Solar



These trends show no evidence of market impact to homes within three miles of the Five Wells Solar facility. To the contrary, subject area sales prices have been strong and show to be improving relative to the control area sales since 2021, and in the years since the Five Wells Solar facility was announced and constructed. Sales to list price ratios are strong, showing an average ratio over 100% for subject area sales in 2022. DOM has increased over time and relative to the control area, but conversations with realtors involved in several transactions revealed that the cause of the longer marketing period for these sales was not associated with the Five Wells Solar facility (instead attributable to other factors such as a need for extensive repairs, a buyer unable to obtain financing, or the property still under construction). During these conversations agents stated the project did not come up in their discussions, or that they have found that the market, in general, is aware of the Five Wells Solar Project and it has not affected the sales they have been a party to.[37] One agent stated they were aware of individual cases where the solar project was a consideration for the potential buyers, and that the project, as well as current market conditions, contributed to longer marketing periods for a property.[38]

[37] Conversation with brokers and agents involved with sales on Wedel Cemetery Road and Shaw Road.
[38] Conversation with agent involved with sales on FM 2184 and Sun Circle.

Lamar County – Impact Solar and Samson Solar

Two utility-scale solar projects in Lamar County, located in northeast Texas adjacent to the Oklahoma border, were analyzed for the purpose of identifying potential market impacts to single-family residential homes located proximate to these projects. Lamar County was chosen due to the prevalence of utility-scale solar activity, both operational and planned, in the county.

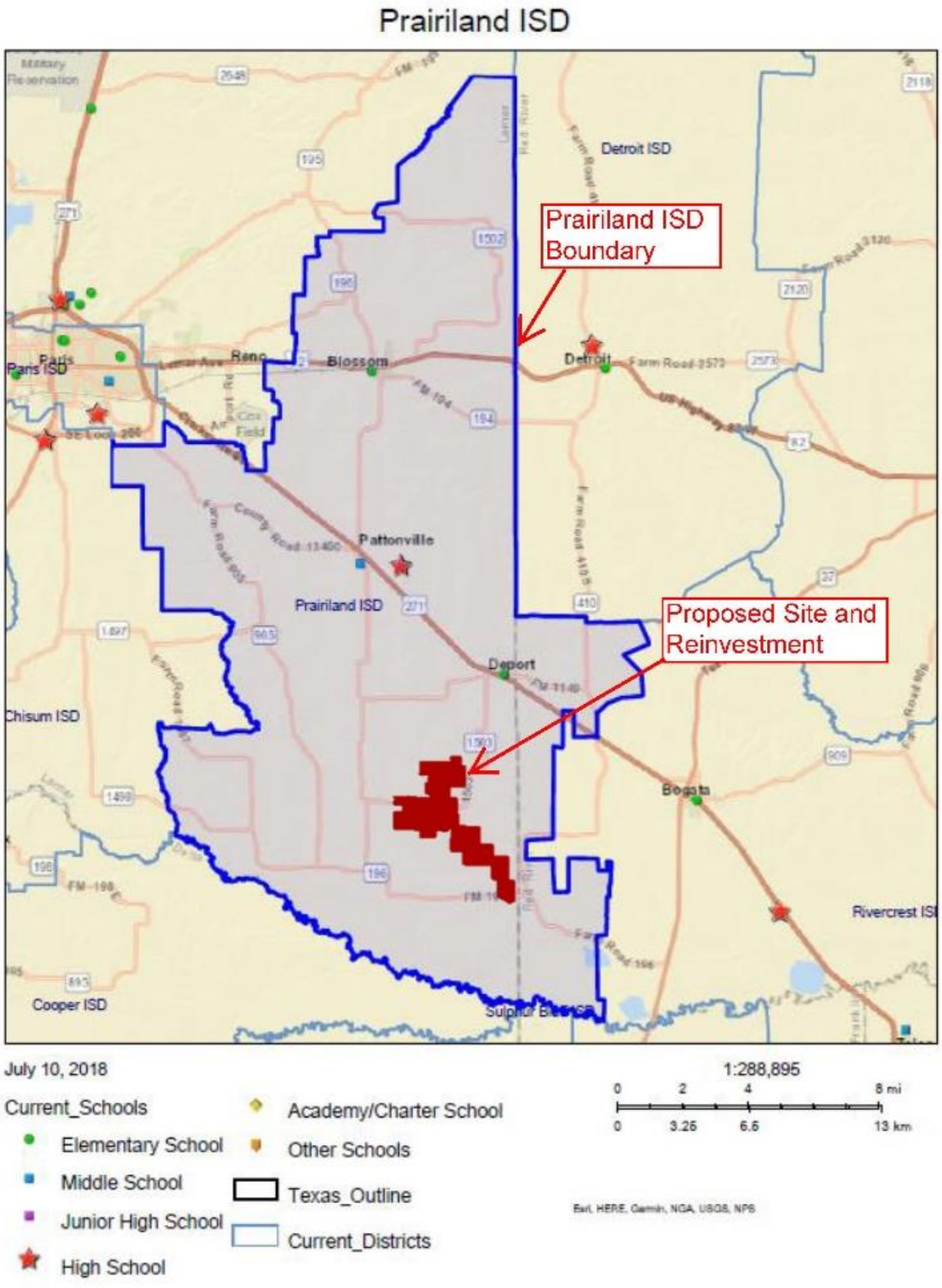
Impact Solar

Impact Solar is a 260 MW facility located at 6795 FM 1503, Deport, Texas. The facility is on approximately 1,500 acres and contains over 650,000 solar panels. The tax abatement application was submitted in August 2018 and approved in January 2019. In March 2020, Lightsource BP announced that financing had been approved, and construction began shortly thereafter. The facility became operational in December 2020.

Figure 28. Aerial photo of Impact Solar[39]

[39] Photo by Lightsource BP.

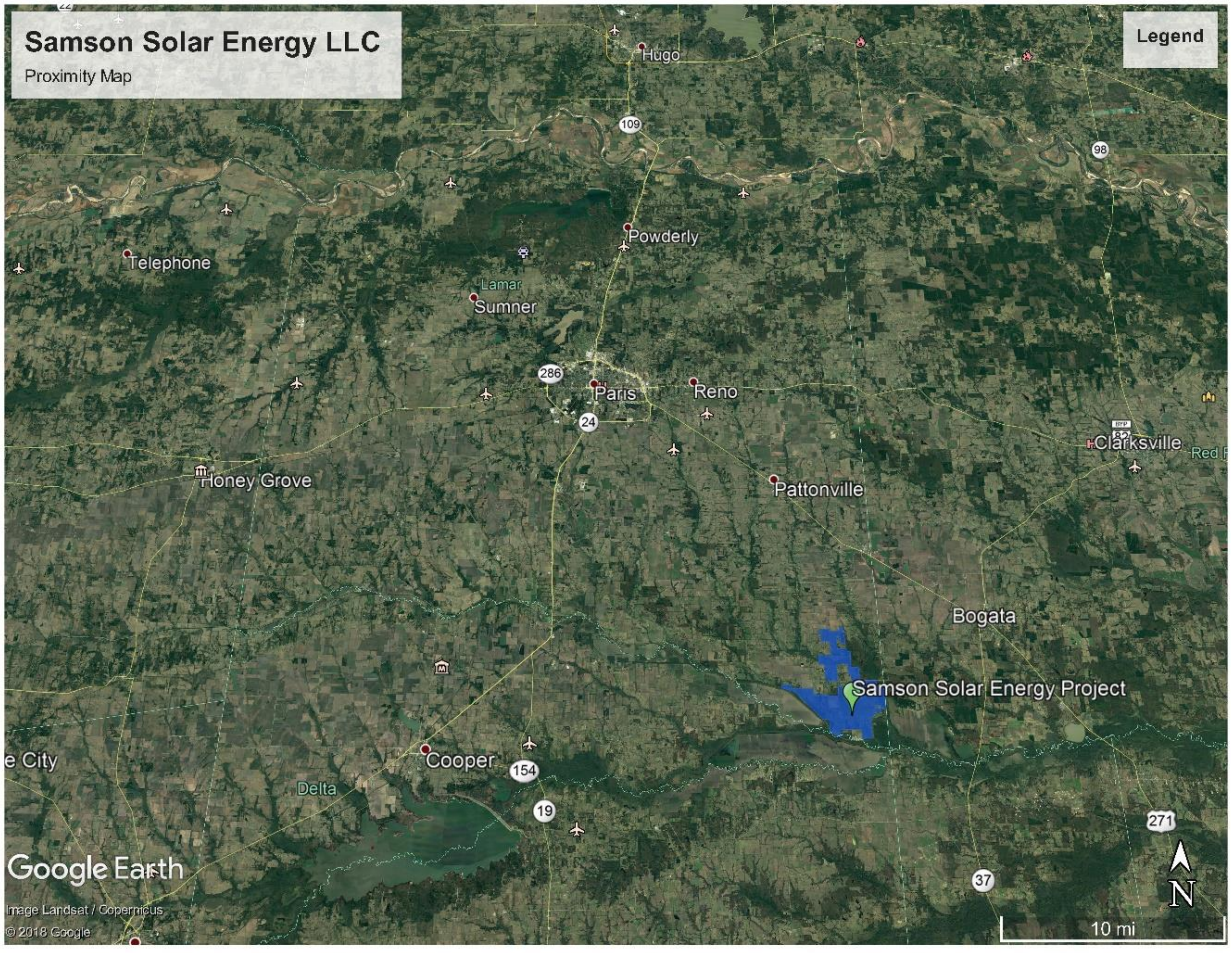
Figure 29. Map of the Impact Solar facility and Prairiland ISD in Lamar County[40]



Samson Solar

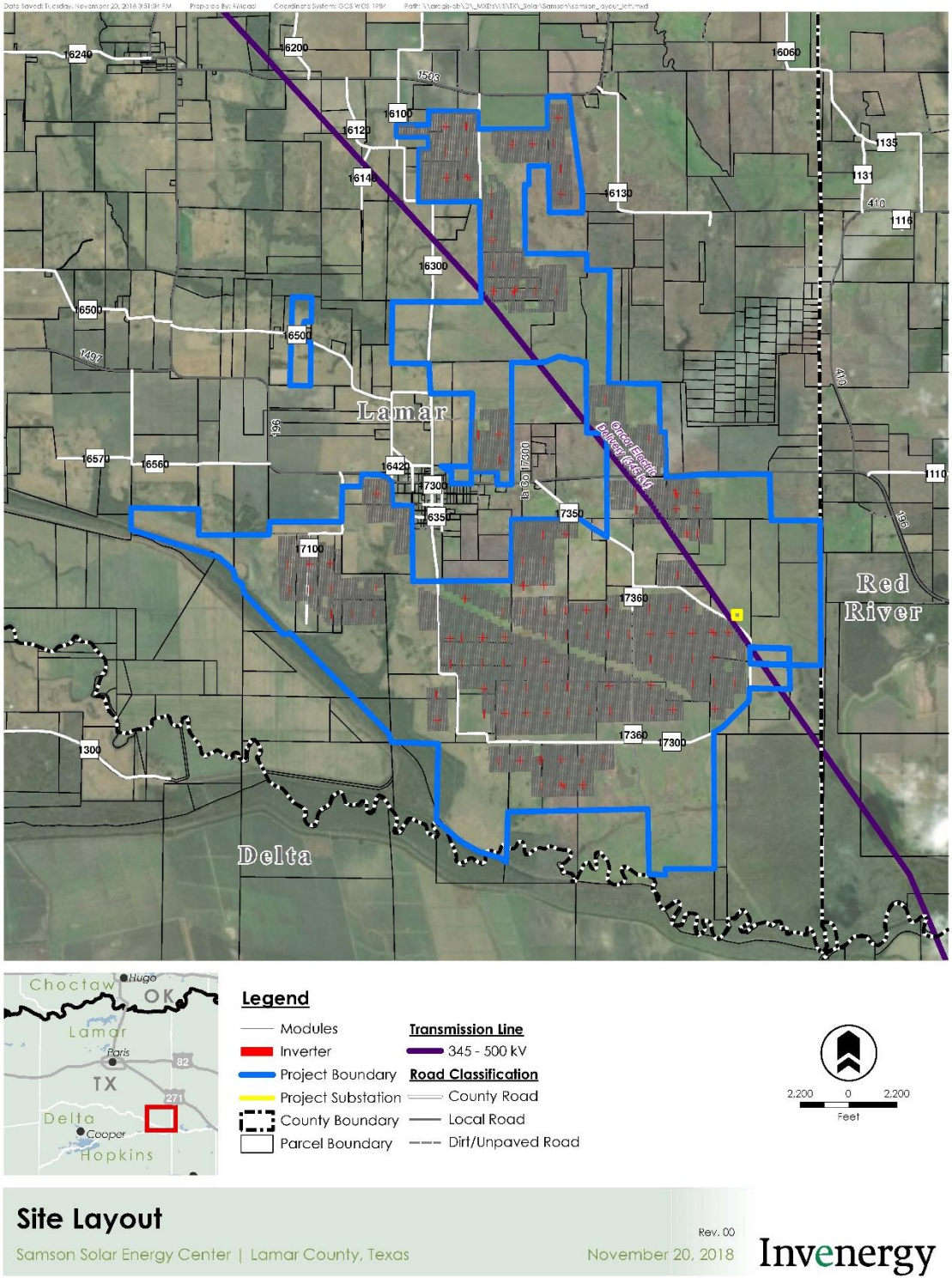
Samson Solar is a multiple-phase project, with individual developments ranging from 200 to 310 MW per installation. The total MW across all sites totals 1,310 MW. Overall, the facility is on approximately 18,000 acres. The Samson Solar Energy Center will be one of the largest solar energy generation facilities in the United States. An application for a value limitation agreement was submitted to Prairiland ISD in January 2019, and tax limitations were approved in May 2019. Construction of the first phase began in July 2020. Approximately 3,435 acres with 250 MW capacity became operational in November 2022, and an additional 3,435 acres are expected to come online in June 2023.

Figure 30. Map of Samson Solar Energy facility in Lamar County[41]



[41] Figure taken from the Application for Appraised Value Limitation to Prairiland Independent School District

Figure 31. Site layout of Samson Energy facility in Lamar County[42]



Due to the location of both Impact Solar and Samson Solar in the southeastern portion of Lamar County, and rural residential development proximate to both solar facilities, sales surrounding the two utility-scale solar facilities were combined for purposes of analysis. Rural residential subject sales are located within the southeast portion of Lamar County, north of the Sulphur River (county line), west of Highway 37 and south of Highway 271. All of these sales are within five miles of either the Impact or Samson Solar facilities. Control area sales are located in southwest Lamar County, west of Highway 24, southwest of the Soil Conservation Service Site Reservoir, and south of Highway 1509 (east and north of the county line). The rural residential development in the control area is similar to the subject area, but the control area sales are not proximate to an existing utility-scale solar development.

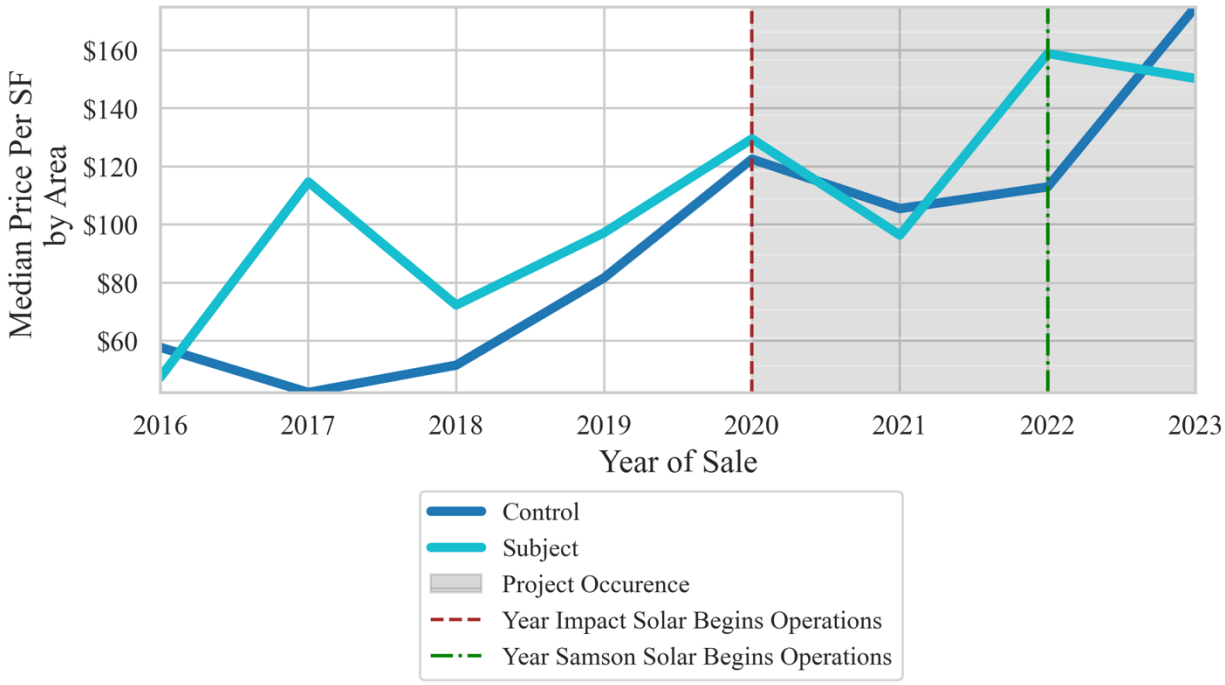
Figure 32. Sales from January 2016 to April 2023 within Lamar County and within five miles of either the Impact Solar or Samson Solar facility

Figure 32 depicts the median price per interior square foot in both the subject area (within five miles of either the Impact or Samson Solar facilities), as well as in the identified control area. The price per interior square foot of living space rose in general over time for both subject and control area properties. The median price per interior square foot in the subject area is generally higher than that in the control area, both before and after construction of the solar facilities. Key dates to consider are Impact Solar's construction and operational start date in 2020, construction of Samson Solar beginning in July 2020, and the beginning of operations at the first phase of Samson Solar in November 2022. Between 2020 and 2022, median prices in the subject and control area both trended together with no identifiable pattern of divergence.

[42] Figure taken from the Application for Appraised Value Limitation to Prairiland Independent School District

However, for Lamar County, some caution must be taken when interpreting results. The county is sparsely populated; therefore, the number of sales in both the subject and control areas in some years are low (e.g., 2 subject sales in 2021, 4 control sales in 2022). For 2023, data collection occurred only through the first three months, and only one sale occurred in each the subject and control area. With the caveat of limited data, there is no clear pattern of price divergence between subject and control areas associated with the solar farm installations.

Figure 33. Median price per interior square foot for the subject and control areas for Lamar County



DOM showed similar trends for both subject and control area homes, providing no indication of market resistance. DOM shortened for sales proximate to either of the solar farms once operations began. The exception is the first three months of 2023, but again, this is driven by the single year-to-date subject sale in that area and is consistent with the previous year's average DOM in the control area. Overall, sales in both subject and control areas tend to have similar sale to list price ratios (5-10%) which appears to be more the result of local market practices, as these discounts were present county-wide, and were just as likely to occur in the years before the solar projects were built as they were in the following years. The one exception is in 2021, in which the sale to list price ratio for the subject area dipped. After further research, it was determined that this was due to the sparsely populated nature of this study area and the resultant effect that the specifics of a single sale can have on the overall results in such a setting. More specifically, there were only

two subject sales that year, the first being a $215,500 house with 1,788 square feet, and the second a 984 square foot home selling for just $71,000. The former sold for a sale to list price ratio of 98% (i.e., a discount of 2%) while the latter sold at a sale to list price ratio of 75%. Given the unusually small size and pricing of this latter property, its reduced sale to list price ratio is attributable to property-specific factors, rather than the result of solar farm construction. This one sale does, however, pull down the median sale to list price ratio for that year, again illustrating the limitations of interpreting the infrequent sales data in Lamar County.

Figure 34. Days on market for the subject and control areas for Lamar County

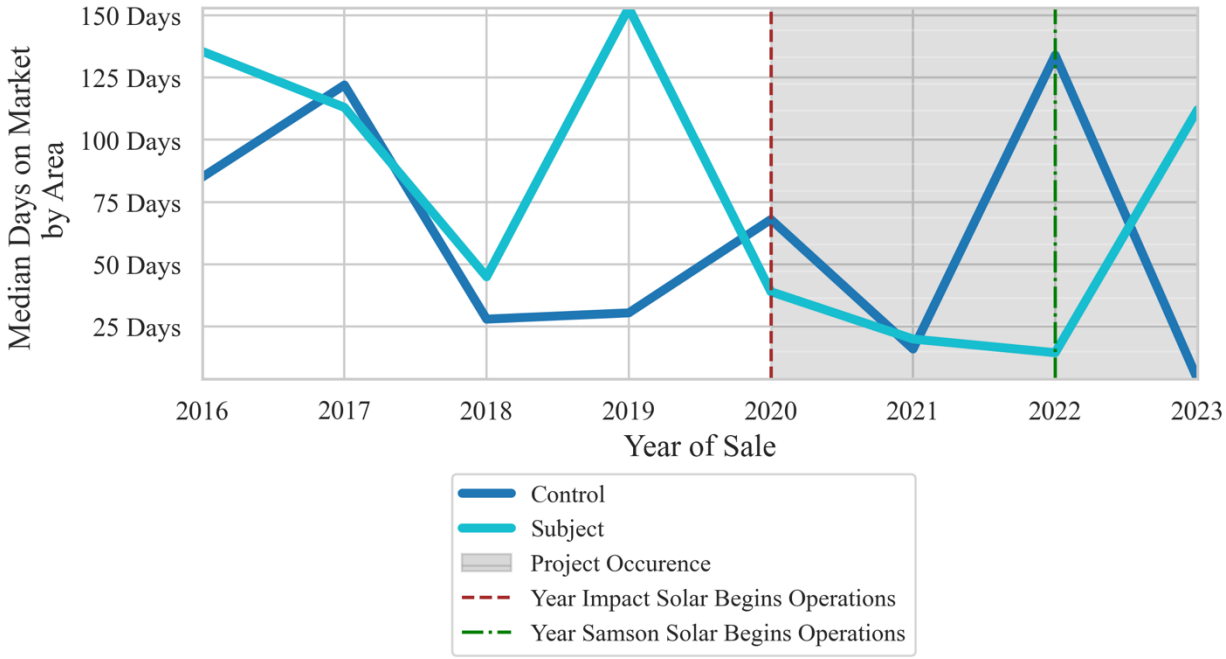
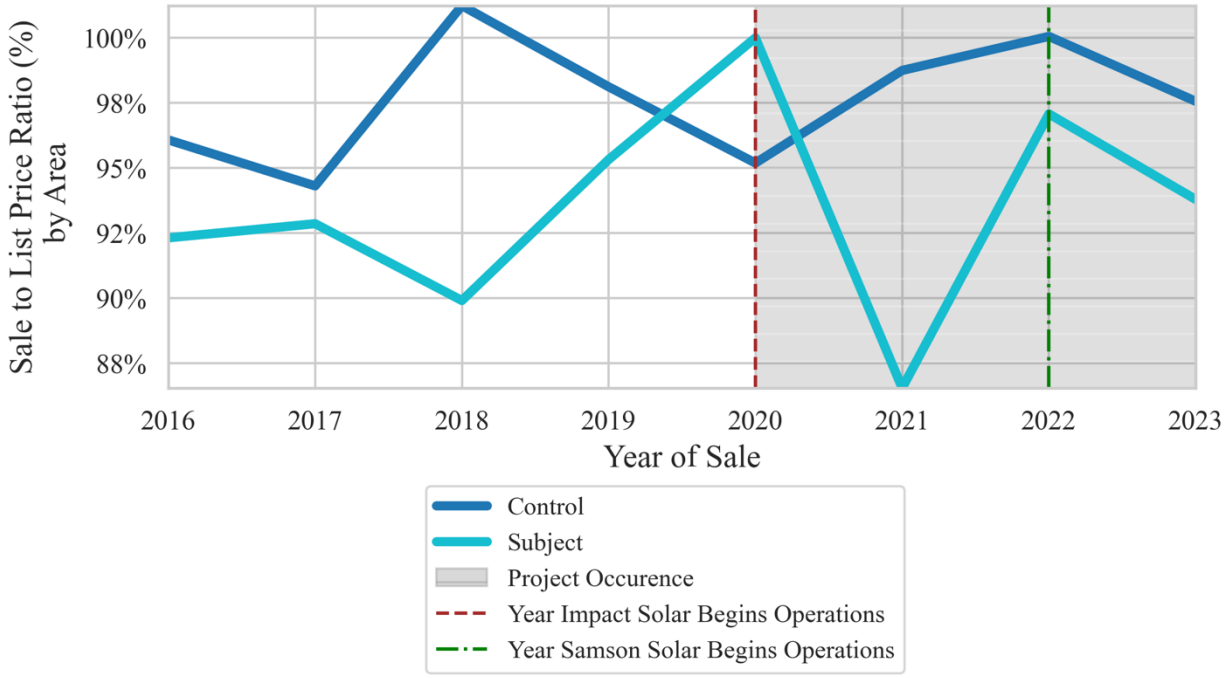


Figure 35. Sale to list price ratio for the subject and control areas for Lamar County



Overall, market trends do not show any evidence of negative impact correlated with the announcement or construction of either the Impact or the Samson Solar facilities in Lamar County. Prices generally trended together, selling at similar prices as control areas after the facilities were constructed, with broadly similar sale to list price ratios and DOM.

Bee County – Sparta Solar

The Sparta Solar facility is part of the larger Helena Energy Center in the northern portion of Bee County, in a rural area north of Beeville. The Helena Energy Center includes both wind and solar generation facilities. Construction of Sparta Solar began in April 2021, with an expected operational date of December 2023. The project is large, with 250 MW across 15,000 acres. An additional 268 MW of wind farm capacity is also a component of this project, with turbines erected over five months beginning in September of 2021.[43] The rural residential area in Bee County surrounding Sparta Solar was chosen for analysis because of the size and publicity of the project, and because of its geographic location in the southeastern portion of Texas.

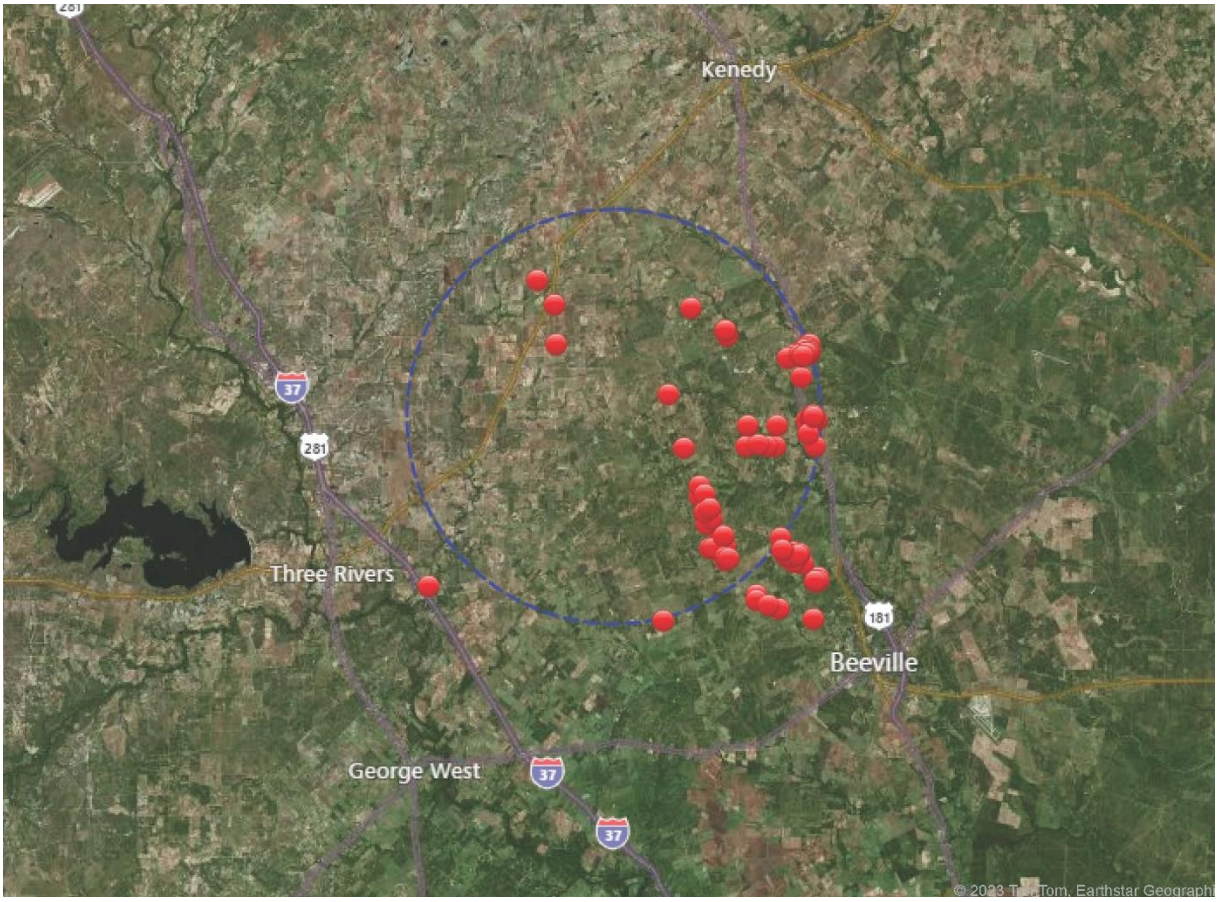
Figure 36. Map of Sparta Solar project in Bee County[44]

For this analysis, the subject area consists of rural residential sales within the boundary of Bee County and within ten miles of the address point for the Sparta Solar facility at 10494 FM 673, Mineral, Texas. The boundary extends further in this analysis than in the analyses for utility-scale

[43] https://helenaenergycenter.com/
[44] Figure taken from the Application for Appraised Value Limitation to Pawnee Independent School District

solar projects in other counties, due to the sparsely populated nature of the rural area. Only three sales of rural residential property transacted through the MLS within five miles of the Sparta Solar facility between 2016 and 2022. Rural residential properties located in the southern portion of Bee County, south of Highway 59 and Highway 202, were used as control area sales.

Figure 37. Sales from January 2016 to April 2023 within Bee County and a ten-mile radius of the Sparta Solar facility

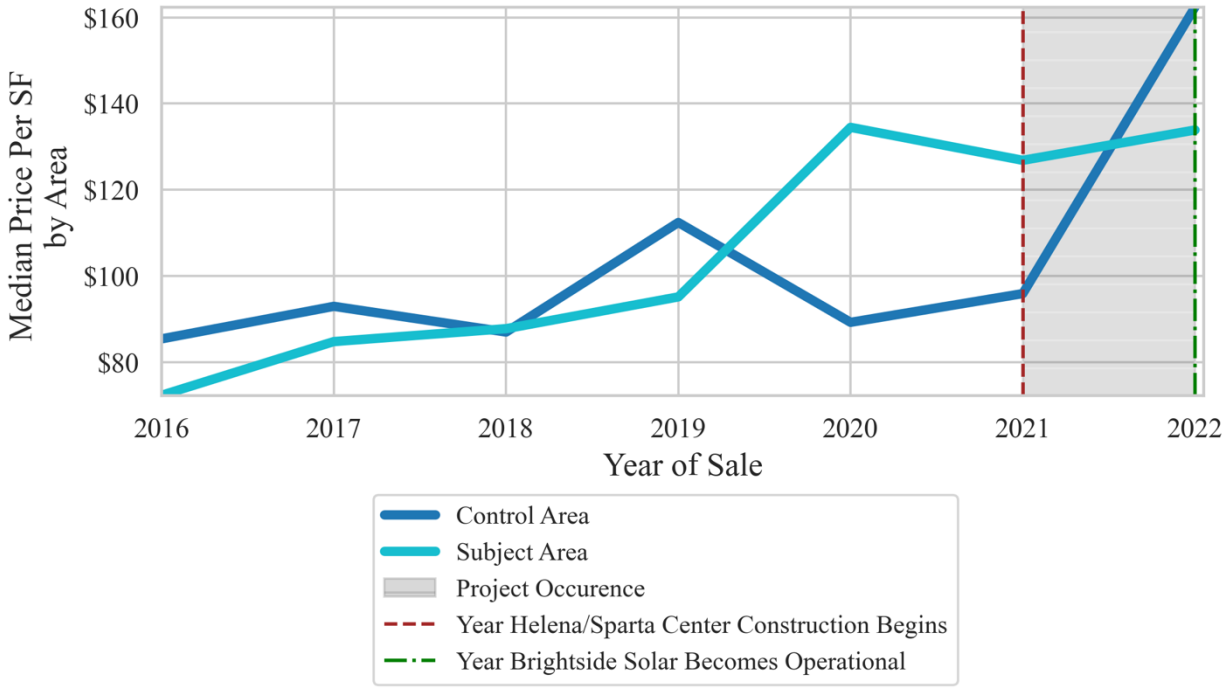


Annual sale counts in Bee County were low, which means that while we can interpret trends over time between the Subject and Control Areas, variation from one year to the next can be overly

influenced by just one or two sales. (For example, there were no sales in 2023 for the Subject Area, except for one whose sale price reflected its state of disrepair).[45]

In Bee County, median price per interior square foot for homes proximate to the Sparta Solar facility sold at no discernible discount relative to homes further away. In some years the average sales price in the subject area was above the average sales price in the control area, and in other years control area prices were above subject area prices. This is partly attributable to the small number of sales each year, but in general, no negative impact or discount is evident in the sales price trends for the subject area proximate to the Sparta Solar facility.

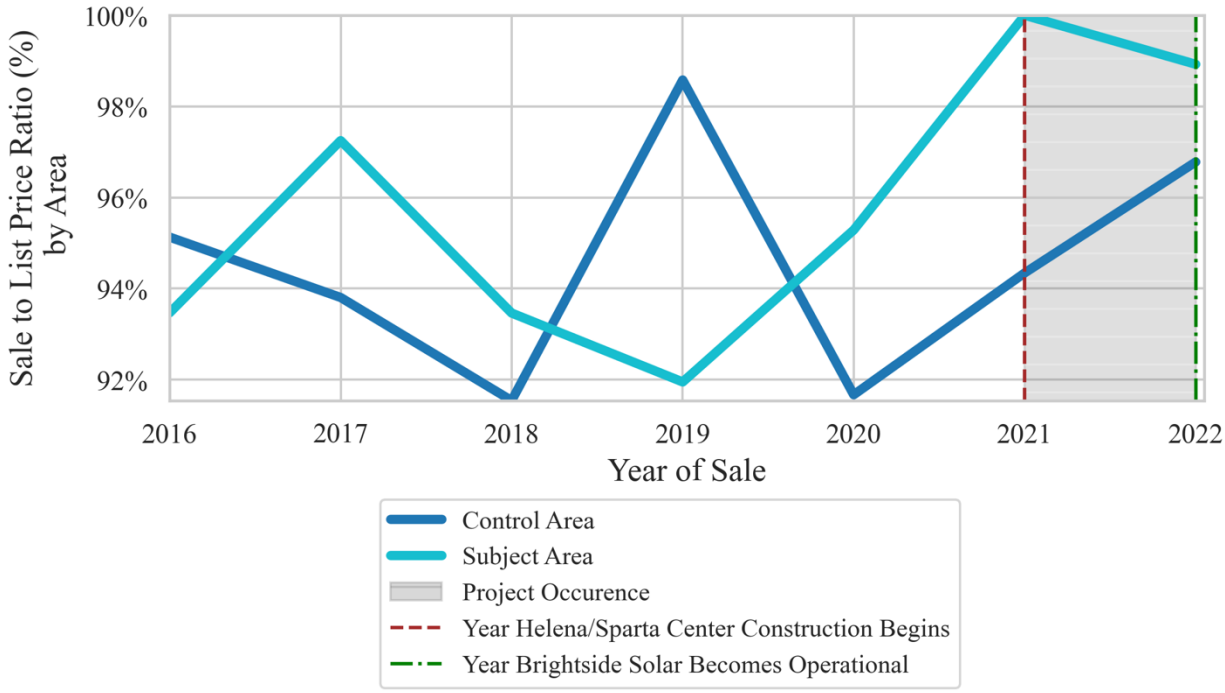
Figure 38. Median price per interior square foot for the subject and control areas for Bee County



[45] We interviewed the listing agent involved in this transaction, and they confirmed that the sale to list price ratio was unrelated to the proximity of the Sparta Solar facility. The agent stated that the property had no view of the solar project and described the purchase price as instead reflecting the expenses needed to restore the property to an adequate condition, along with negative circumstances involving the next-door neighbor.

Trends in the average sale to list price ratio give a similar picture. In recent years, subject area sale to list-price ratios have been stronger, but only by a few percent.[46] Overall, no negative market impacts are apparent for homes proximate to the Sparta Solar facility in Bee County.

Figure 39. Sale to list price ratio for the subject and control areas for Bee County



Conclusion

The market trend analysis for six utility-scale solar projects in varying geographic locations across Texas, in varying residential markets, and at different stages of project development showed no evidence of negative market impact for proximate residential properties. Sale metrics – price per interior square foot, sale to list price ratios, and DOM – in subject areas follow generally similar trends when compared with control area sales located further from solar projects. Further research into individual sales and interviews with local market players confirmed that the market participants were knowledgeable of the solar projects, and this knowledge did not have a negative impact on the sale price or marketing time. In general, and consistent with the published literature, any potential for individual sales to be affected tends to involve properties with a direct view of a utility-scale solar project; but overall, it appears a market and demand exists for those properties at competitive prices.

[46] The MLS System for Bee County did not provide data on the number of Days on Market for each sale.

Real Property Analytics, Inc. (RPA) is a real estate appraisal and consulting firm specializing in analyzing the effects of potentially adverse influences on the market value of residential, commercial, industrial, and agricultural properties. RPA has provided real estate analysis services on assignments throughout the U.S. and in Canada for over 20 years. Our firm has familiarity and expertise in specialized valuation methods used in complex assignments, including econometrics and statistical modeling, paired sales analysis, and case study research. RPA principals have provided litigation support and expert witness testimony in both federal and state courts throughout the U.S.

Erin M. Kiella, PhD, is executive vice president and consultant at Real Property Analytics, Inc. Dr. Kiella has been with Real Property Analytics since 2015. Her expertise is in complex real estate valuation techniques used to quantify potential property value diminution from various detrimental conditions, including environmental contamination or alleged contamination from both on and off-site sources. She has expertise in statistical modeling and econometrics. Dr. Kiella has provided litigation support involving the development of damage and rebuttal opinions in class action and mass tort litigation cases throughout the United States, both at the certification and merits stages. Dr. Kiella was formerly an assistant research economist with the Real Estate Center at Texas A&M University where her research focused on rural land market trends, agricultural lending, and estimating econometric models forecasting rural land prices in Texas, Alabama, Mississippi and Louisiana. Before joining the Center in January 2018, Dr. Kiella was a strategy consultant with California-based, The Wonderful Company, research assistant with the Agricultural and Food Policy Center at Texas A&M University and consultant with the Federal Reserve Bank of Chicago. Dr. Kiella has a PhD in Agricultural Economics from Texas A&M University and a B.B.A. in Finance and Economics from Loyola University in Chicago, with honors. She is also a member of the American Society of Farm Managers and Rural Appraisers.

Jennifer Pitts, MAI, CRE, is the President of Real Property Analytics, Inc. and has over 15 years of experience in real estate consulting and appraisal throughout the United States and Canada. She specializes in analyzing complex valuation issues, including the valuation of properties impacted by environmental contamination or other disamenities, and has been retained as a testifying expert on litigation matters before federal and state courts in Texas, Florida, Georgia, New York, Montana, California and elsewhere. These matters involved: the impacts of soil, groundwater, airborne and surface water contamination and alleged contamination on property values; real estate issues related to proposed environmental class actions; the impacts of high voltage electric transmission lines on property values; the valuation and highest and best use of properties subject to eminent domain; and real estate development feasibility. Ms. Pitts is a graduate of Texas A&M

University with a master's degree in Land Economics and Real Estate and a bachelor's degree (summa cum laude) in Finance. She currently holds the professional designation of Counselor of Real Estate (CRE), a professional designation that is awarded by invitation only to a select number of professionals recognized for their expertise, experience and ethics in providing real estate counseling and advisory services. She is also a State-Certified General Real Estate Appraiser in Texas (TX-1380184-G) and other states, and a Designated Member of the Appraisal Institute.

Chris Yost-Bremm, PhD, is an Assistant Professor of Finance at San Francisco State University. Dr. Yost-Bremm has been with Real Property Analytics, Inc. since 2014, developing and critiquing statistical methodologies involving real property on behalf of numerous firms and individuals. Dr. Yost-Bremm has significant experience in analyzing the impacts of environmental contamination, particularly under class action or mass tort claims (at both the certification and merit stages). He has also provided statistical analysis services under non-litigation circumstances, involving environmental cleanups by international government agencies. In addition to environmental contamination, Dr. Yost-Bremm has provided analytic services for mining and other industrial properties and has analyzed numerous other commercial and residential property types under complex economic situations. He has assisted in developing real property testimony involving class-level insurance claims, among other matters. Dr. Yost-Bremm holds a PhD in Finance from Texas A&M University, an MBA from California State University (with distinction), and undergraduate degrees in management and international economics (with honors).