

Do Utility-Scale Solar Projects Affect Nearby Residential Real Estate Markets?

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Abstract

Although public support exists for the development of green energy in the form of large-scale solar projects, specific proposed projects are occasionally met with local opposition. Homeowners in surrounding areas may express concern regarding negative impacts to their properties due to the construction and operation of a large-scale solar project. This research was intended to address the question of whether, in general, residential market areas proximate to a large-scale solar project should expect to see a drop or decline in property value. The market trend analyses of residential homes in markets proximate to three large-scale solar projects did not provide any evidence of a negative impact on sale prices, days on market, or sale price-to-list price ratio. Our findings do not indicate a negative impact due to proximity to a large-scale solar project. The market trends analyses presented here, in combination with the findings from published literature, provide evidence that market demand exists at competitive prices for residential properties proximate to large-scale solar facilities. These findings cannot be generalized or assumed to apply to every market or solar project, as any potential impacts depend on many factors particular to individual projects and locations. Individual, market-specific analysis must be conducted to support any estimate of diminution in value.*

What Is a Typical Utility-Scale Solar Project?

While no uniform definition for a utility-scale solar project exists, the industry tends to use two defining features for classification: size and energy use. The Solar Energy Industries Association (SEIA) defines a utility-scale solar project as one generating over one megawatt (MW) of solar energy. The National Renewable Energy Laboratory defines a project as being 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 developers. In some cases, developers purchase the land where the substation or operation and management buildings are located. Land with access to transmission lines and with a flat to slightly sloping topography and ideally a south-facing slope is preferred.¹

Twenty- to thirty-year leases with a fixed-rate

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

lease structure are typical. Leases have two lease rate structures based on whether the project is in the development phase or the operational phase. Development phases typically last three to five years, while the operational phase lasts twenty to thirty years. The lease rates for the operational phase are both inflation-adjusted and allocated at the start of each decade following the initiation of the lease (i.e., Rate 1 for Years 1–10, Rate 2 for Years 11–20, and Rate 3 for Years 21–30). 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 land usage (i.e., the length of road developed or underground cable installed). 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.

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 or transfer their interest in the lease or the underlying real property without the consent of the tenant. 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 at a single site or for one project to extend over multiple properties. 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.

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

solar panels on their property. The decommissioning process must also be referenced in the lease. The language states that the tenant must restore the surface of the solar panel assembly, 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 time frame (e.g., 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

Solar installation and production in the United States and particularly in Texas is growing rapidly. As of the second quarter of 2024, there was approximately 209.8 gigawatts (GW) of solar power capacity installed in the United States, translating to enough electricity generation to power 35.8 million homes. In 2010, solar power accounted for only 0.1% of the United States' electrical generation. In 2024, it accounted for over 64%. Solar power has also outpaced other energy-generating sources in new electric capacity additions. In the second quarter of 2024, solar power accounted for 67% of all new electric capacity added to the grid.²

Texas has 34,906.68 MW of installed solar power and ranks second in the United States as of the third quarter of 2024 for installed solar electricity capacity.³ This translates to enough electricity to power over 4.06 million homes and represents 6.7% of the state's electricity usage.⁴ Exhibit 1 shows the capacity of annual solar installations in Texas from 2014 to 2024.

The United States is expected to have nearly 673 GW of total solar capacity installed by 2034.⁵ Texas is expected to rank first in installed solar capacity, growing to 50 GW through 2029.⁶

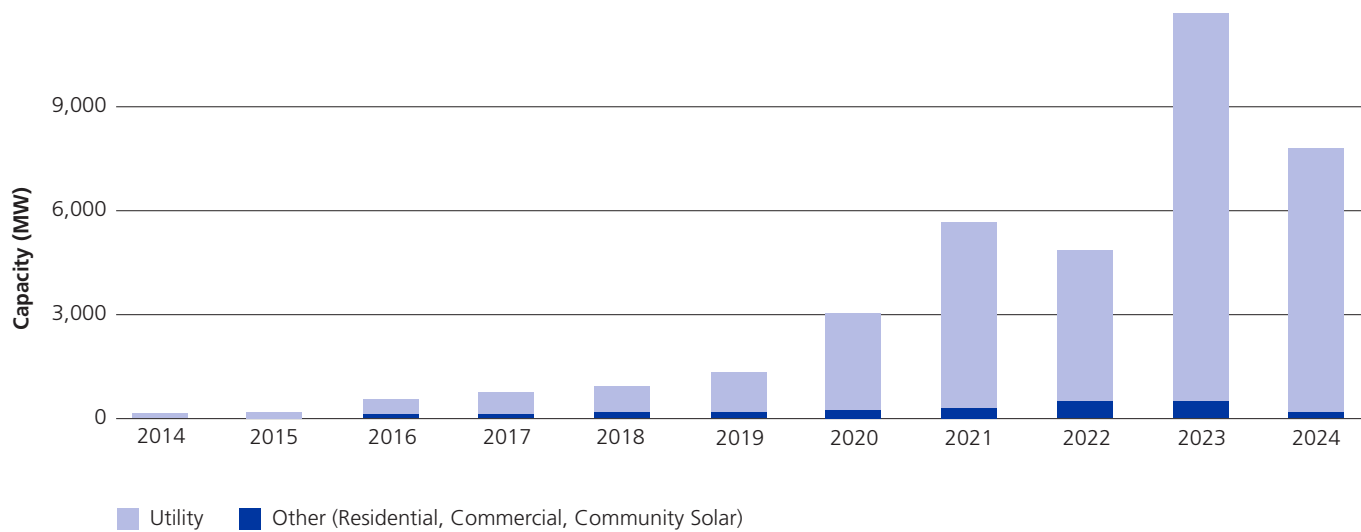
2. Solar Energy Industries Association (SEIA), <http://bit.ly/4IRIZGm>.

3. SEIA, <http://bit.ly/45GGukj>.

4. State Solar Spotlight, published for SEIA, September 2024.

5. SEIA, <http://bit.ly/47CH5F9>.

6. SEIA, <http://bit.ly/45GGukj>.

Exhibit 1 Annual Solar Installations in Texas

Source: Solar Energy Industries Association (SEIA), <http://bit.ly/45GGukj>

Perspectives from Published Studies

Research on the impact of utility-scale solar projects on surrounding property values is limited. Relevant published literature revealed that, in general, the public supports the development of large-scale solar projects, yet when specific projects are proposed they are occasionally met with local opposition. Solar panels can affect the visual landscape and reflect sunlight.⁷ Survey responses have found that the visibility of a project and its size or installed capacity may affect public perception surrounding a proposed solar project.⁸

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; as a result, effects from something such as a utility-scale solar project 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 individual transactions. The larger the geographic area and the wider the variation in property characteristics, the less representative an average effect of each individual home within the study area will be. For example, the average impacts derived from a study of newly constructed single-unit 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 to 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 val-

7. M. I. Drees and H. R. A. Koster, "Wind Turbines, Solar Farms, and House Prices," *Energy Policy* (2021): 1–11.

8. P. Roddis et al., "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 et al., "Utility-Scale Solar and Public Attitudes toward Siting: A Critical Examination of Proximity," *Land Use Policy* (2016): 491–501.

ues. 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 sale prices of houses near solar farms were compared to the sale 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%.⁹

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 for properties near more than 1,500 large-scale photovoltaic projects (LSPVPs) in six states. The study concluded that the effects of large-scale solar projects cannot be generalized, as any potential effects depend on many factors particular to individual projects or locations. The study also found that these factors are not uniform across different projects or in different locations, meaning that a result found in one location cannot be applied or used to understand potential effects 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 located two to four 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.¹⁰

A study published in 2023 used hedonic regression analysis to analyze the impact of solar proj-

ects 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 an operational solar farm.¹¹

Market Trends Analysis of Specific Utility-Scale Solar Projects in Texas

Three utility-scale solar projects in two Texas counties were identified for the purpose of analyzing and understanding the potential effects of utility-scale solar projects on single-unit residential property values. The market trend analysis tracks data on single-unit residential real estate transactions involving properties in proximity to solar projects in Tom Green and Bell Counties.¹² 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 sale prices, the ratio between sale prices and listing prices, and changes in exposure time (i.e., the amount of time the property is on the market before it sells, or days on market).¹³ The analysis performed here considers data on these three factors.

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

9. M. I. Drees and H. R. A. Koster, “Wind Turbines, Solar Farms, and House Prices.”

10. For illustrative purposes, a 1.5% reduction of a \$350,000 home would be \$5,250 or yield a value of \$344,750.

11. D. Maddison et al. “The Disamenity Impact of Solar Farms: A Hedonic Analysis,” *Land Economics* (2023): 1–16.

12. 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 (*The Appraisal of Real Estate*, 15th ed., [Appraisal Institute, 2020], 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 marketwide effect, further analysis is required to identify and quantify diminution in value, if any, at the individual property level. *The Appraisal of Real Estate* 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 projects, wind turbines, or high-voltage transmission lines. These recognized techniques include paired sales analysis, case study analysis, multiple regression analysis, and the analysis of income and yield capitalization rates for income-producing properties (*The Appraisal of Real Estate*, 15th ed., 188).

13. *The Appraisal of Real Estate*, 15th ed., 389.

market surrounding the utility-scale solar project, or 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.¹⁴ 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 sale prices for adjacent or proximate properties, longer marketing time or days on market, or larger differences between the original listing price and the ultimate sale 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 or 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 control areas for each analysis were selected to be as similar as possible to the subject area in terms of property and market characteristics, but the market trend analysis does not consider the individual property characteristics of each sale (e.g., age, lot size, condition, number of bedrooms and bathrooms). Therefore, some of the observed differences between the subject and control areas evident in the market metrics studied are due to differences in individual property characteristics and sale terms. These market fluctuations change from year to year and between the subject and control areas studied. The subject is slightly higher

than the control area in some years and in some areas, and the reverse is true in other areas and time periods. To quantify diminution in value at a specific property or group of properties, further analysis incorporating and controlling for these individual property variables would be necessary.

While year-to-year fluctuations are typical in real estate data, the presence of a dip or divergence in the subject area relative to the control area that correlates with the date of project announcement or the commencement of construction or operational activities might indicate a negative impact attributable to solar project proximity. 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 that are surrounded by either 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 the surrounding land use, one can logically presume that proximate land values are likely unaffected. As a result, the analysis here focuses on projects where the surrounding areas have contrasting land use types or where the land use has been converted for the project (i.e., solar acreage previously used as rural residential).¹⁵ Projects of significant size (100 MW or greater) were also selected, as these have the most significant potential viewshed impacts and drastically alter an area’s landscape.

Furthermore, rural and suburban residential markets are unique, with different market partici-

14. Identifying control properties near subject properties helps alleviate the potential for locational market differences that could preclude comparability.

15. This is consistent with the body of literature reviewed stating that any potential impact on the value of surrounding real estate would be expected to be highest in areas with residential development.

Exhibit 2 List of Solar Projects Considered by County

Tom Green County	Bell County
Rambler Solar	Five Wells Solar
Concho Valley Solar	

pants and different value considerations.¹⁶ To understand how a utility-scale solar project may affect each market, projects located in both rural and suburban areas as well as in various geographic locations throughout the state of Texas were considered. For example, projects near planned developments (smaller tract properties with homogenous builders 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 explain how the unique perceptions of these different market participants may impact the sales of residential properties near utility-scale solar projects.

Solar projects that are either operational or under development or construction are considered in this research. People in 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.

Utility-scale solar projects that (1) are operational or under development, (2) have a capacity of 100 MW or greater, (3) are surrounded by a sufficient number of residential properties, and (4) are located in either a rural or suburban area were considered for this research. Three utility-scale solar projects in two Texas counties were identified, fulfilling the market and locational characteristic requirements discussed. Market

Exhibit 3 Map of Utility-Scale Solar Projects Considered in the Analysis



trend analysis was performed for these six projects. Exhibit 2 lists the solar projects located in each county, and a map indicating the location of each project is shown in Exhibit 3.

Tom Green County: Rambler Solar Facility and Concho Valley Solar Facility

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-unit residential homes located near these projects. The Rambler Solar facility and Concho Valley Solar facility were chosen due to their location near the county seat of San Angelo and proximity to residential developments.

Rambler Solar Facility

The Rambler Solar project 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 the equivalent of approximately 40,000 homes when operating at full capacity. It was the first solar project in

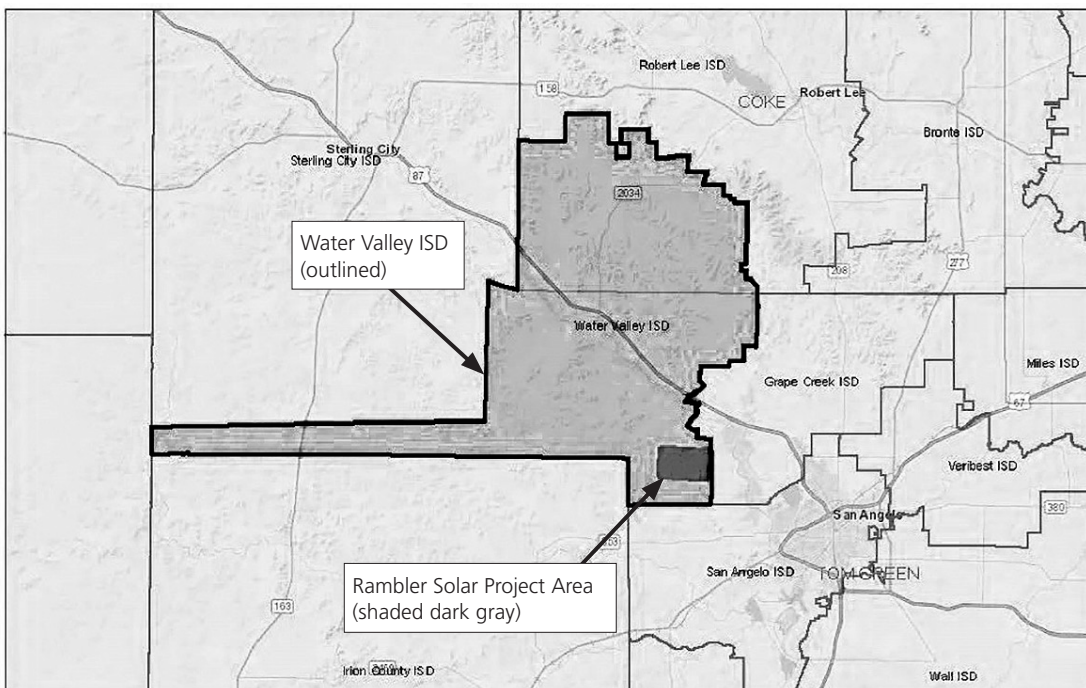
16. For this reason, it would be inappropriate in a sales comparison analysis to use a property located in an urban center as a comparable sale to a property located in a remote rural location.

Exhibit 4 Aerial Photo of Rambler Solar Facility



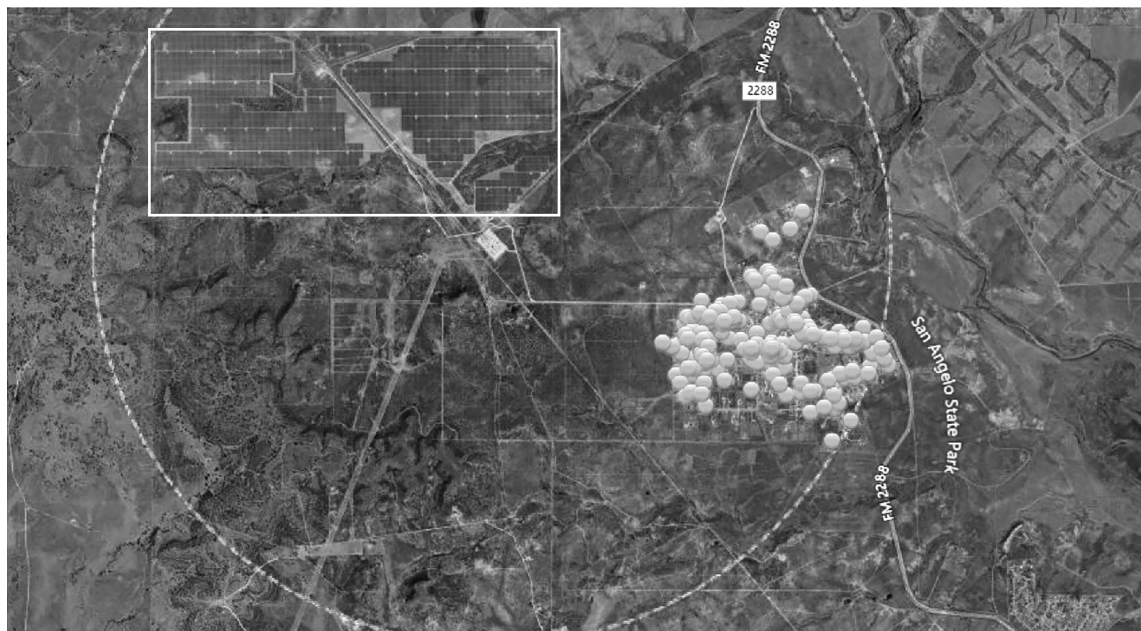
Source: Duke Energy

Exhibit 5 Location of Rambler Solar Facility and Water Valley Independent School District



Source: Application for Appraised Value Limitation to Water Valley Independent School District

Exhibit 6 Sales from July 2020 to March 2023 within a Three-Mile Radius of the Rambler Solar Facility Entrance



Tom Green County and was 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 construction began shortly thereafter. Commercial operation began in July 2020. An aerial view of the project is shown in Exhibit 4, and the location of the project in relation to the Water Valley school district is shown in Exhibit 5.

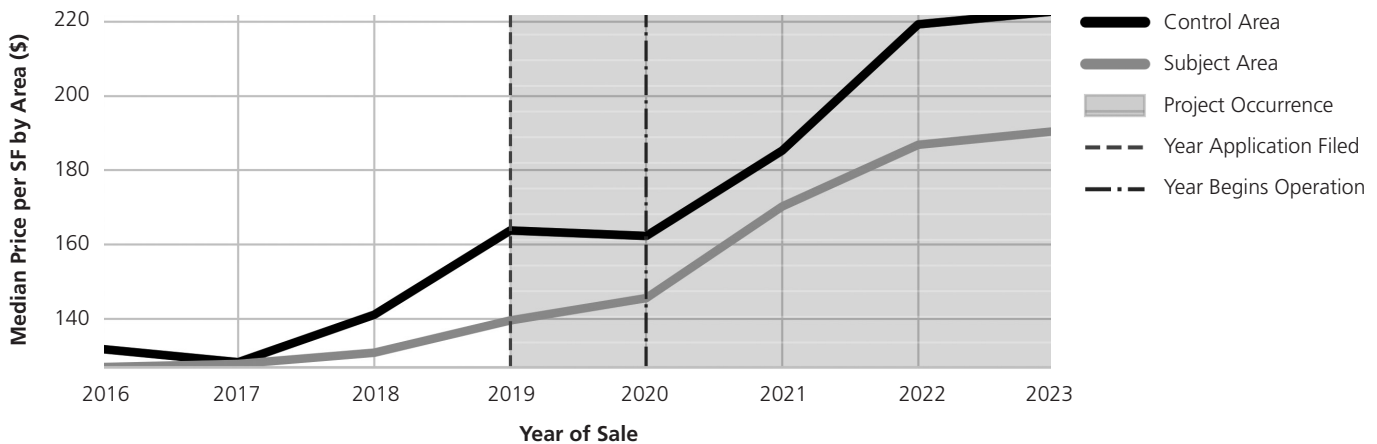
Buffalo Heights, located approximately 1.5 miles southeast of the Rambler Solar facility, is the closest residential development. The planned residential community, first developed in 2008, is located about 10 miles northwest of San Angelo. These homes, built from 2009 to the present, have relatively 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 the map shown in Exhibit 6, the majority of these sales are located within the Buffalo Heights development.

Several single-unit residential developments similar to Buffalo Heights but not located near a utility-scale solar project were selected for comparison.¹⁷ Control area sales were collected in the area south of San Angelo and north of Christoval (including The Haciendas at Christoval, Oak Mountain Estates, Stonewall Reserve, and Pecan Creek residential developments), as well as the area north of Wall and east of San Angelo (including the Iron Horse and Stonewall Range residential developments). These areas were selected given their similarity to the subject sales in Buffalo Heights in terms of their larger lot sizes, similar approximate distance to San Angelo, and a majority of homes with relatively newer construction (post-2000). Data on all sales transacting through the Navica MLS from January 2016 through March 2023 was collected for the purposes of this analysis.¹⁸

17. 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 rather than considering citywide or countywide averages.

18. Because we are using the MLS, not all sales occurring in the areas are necessarily being captured, and this is therefore a representative sample.

Exhibit 7 Median Price per Interior Square Foot for the Subject and Control Areas for the Rambler Solar Facility

Data on the median price per interior square foot of living space, sale price-to-list price ratio, and days on market was obtained for subject and control area sales. If the announcement or construction of the Rambler Solar project had a negative impact on sale prices in the surrounding market area, the sales data would dip or diverge in the subject area as 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 price-to-list price ratio (i.e., the sale price of the property is lower compared to the list price) or the average days on market increases following the key dates.

Exhibit 7 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 the 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 become 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 diver-

gence in the control areas continued until 2019. Key dates to consider are Rambler Solar facility'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 the Rambler Solar facility continued to rise, narrowing the price gap between the two areas. The prices in both areas generally trended together throughout 2020, the year Rambler Solar began operations (in July). In 2022, control area prices grew at a faster rate, which is consistent with the number of new construction homes becoming 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. (Year values on the x-axis represent the beginning of each year.)

Exhibit 8 graphs days on market, showing similar trends for both proximate and distant homes and indicating no market resistance. Exhibit 9 graphs the sale price-to-list price ratios. Sales proximate to the Rambler Solar facility 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.

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 rela-

Exhibit 8 Days on Market for the Subject and Control Areas for the Rambler Solar Facility

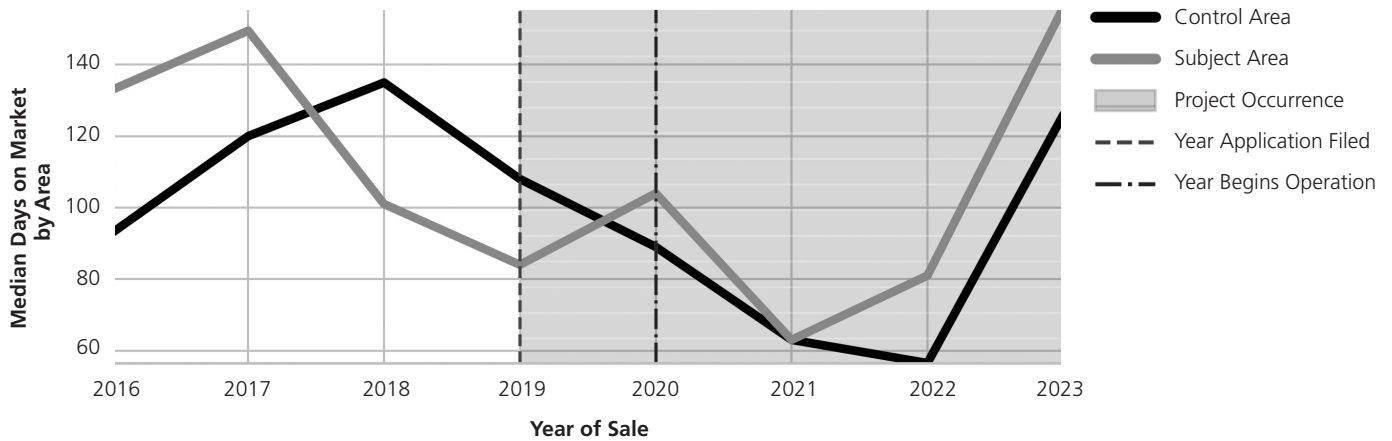
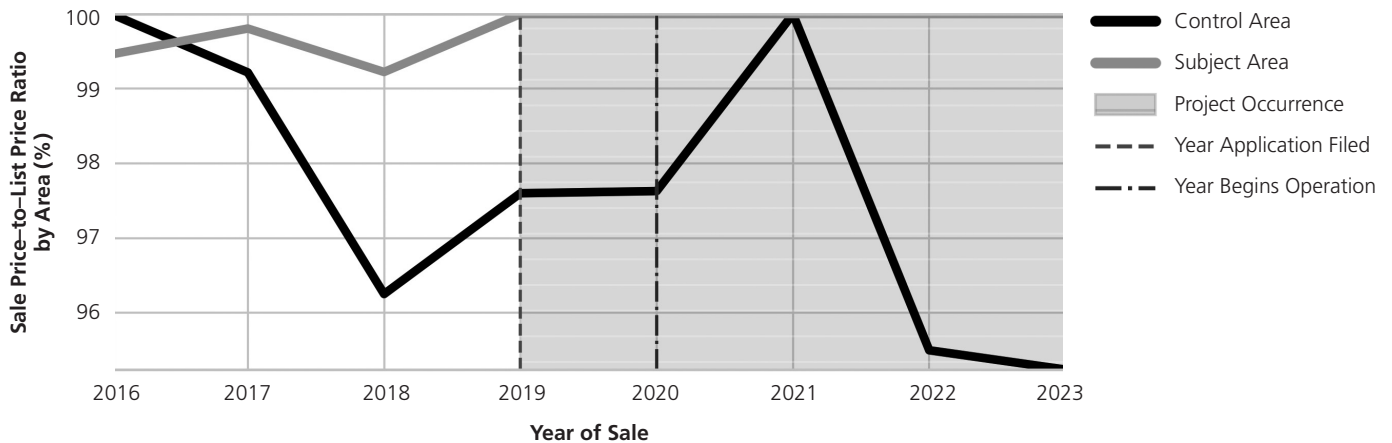


Exhibit 9 Sale Price-to-List Price Ratios for the Subject and Control Areas for the Rambler Solar Facility



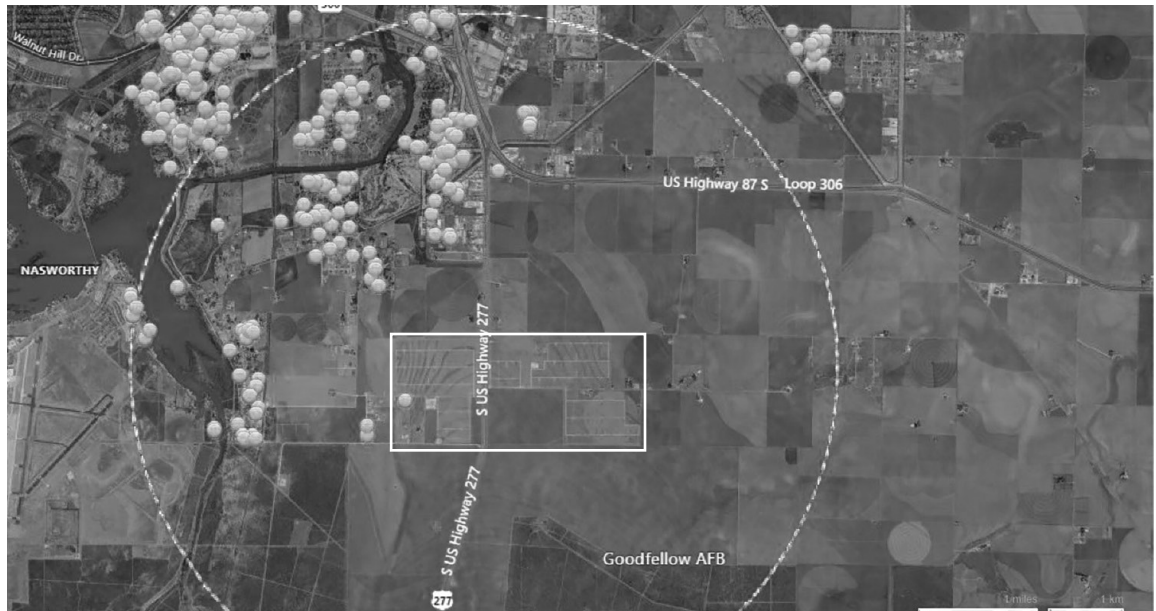
tive to control area prices as the Rambler Solar project was announced and constructed. Subject area sales near the Rambler Solar project sell at a higher sale price-to-list price ratio on average, and the days on market has fluctuated over time but is generally consistent with the marketing time for homes in the control area. 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 the literature, which concludes that property value impacts are most likely to occur 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 Facility

The Concho Valley Solar project is located approximately 1.5 miles to the southeast of a residential development in San Angelo. Some rural homes are located in closer proximity to the Concho Valley Solar project. 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 the project became operational in December 2022.

Data was collected on subject area residential sales from January 2016 to the present. Compara-

Exhibit 10 Sales from January 2016 to March 2023 within a Three-Mile Radius of the Concho Valley Solar Facility



ble properties were located within three miles of the Concho Valley solar facility, south of the Concho River and Highway 87 N, which serve as physical barriers separating properties north of the solar project.¹⁹ These sales are primarily located in two neighborhoods in San Angelo: the Country Club neighborhood and the Nasworthy neighborhood. Exhibit 10 maps sales within a three-mile radius of the facility between January 2016 and March 2023.

For the purpose of this analysis, sales located in these same neighborhoods but north of the Concho River and Highway 87 and sales located west of Lake Nasworthy were selected as control areas. These sales are in the same general neighborhood as the subject sales but are physically separated from the Concho Valley Solar facility by water or a major highway.

Exhibit 11 graphs the median price per interior square foot for the subject and control areas. It shows that 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.

Exhibit 12 graphs the days on market for the subject and control areas, and Exhibit 13 graphs the sale price-to-list price ratios for the subject and control areas. The number of days on market were generally similar or slightly lower (i.e., selling quicker) than they were for homes further away. This was a difference that both predated and continued after the announcement and construction of the Concho Valley Solar project. Sale price-to-list price ratios also trended closely with homes further away both during and after the announcement and construction phases of the project, with no discernible divergence occurring in the data.

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 sale 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 sale price-to-list price ratios and days on market have generally trended with that of control area properties throughout the time period studied, both before

19. A physical barrier acts as a feature that physically separates areas and as a result creates differing experiences for property owners across such divides.

Exhibit 11 Median Price per Interior Square Foot for the Subject and Control Areas for the Concho Valley Solar Facility

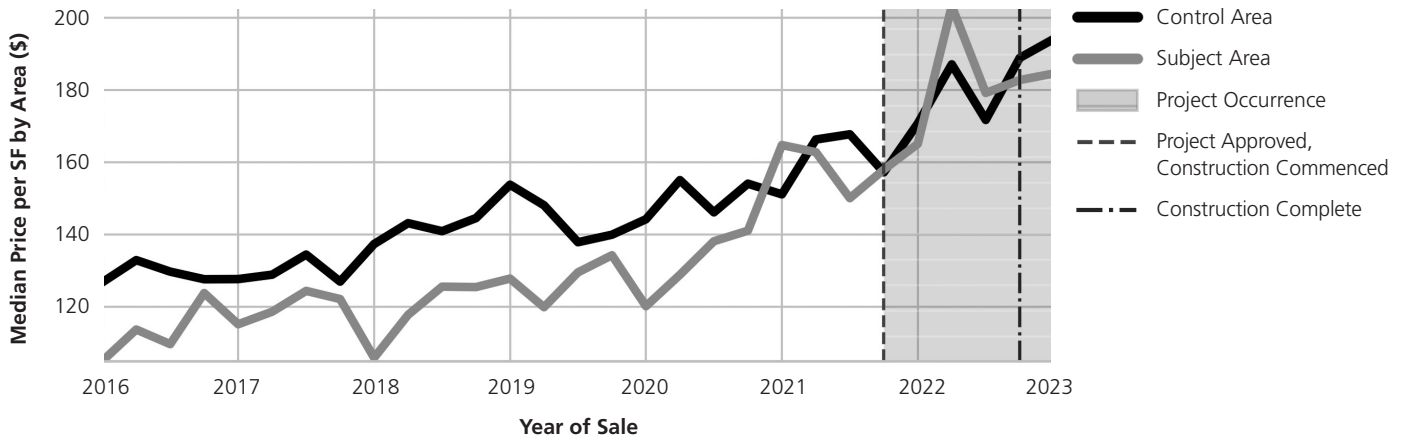


Exhibit 12 Days on Market for the Subject and Control Areas for the Concho Valley Solar Facility

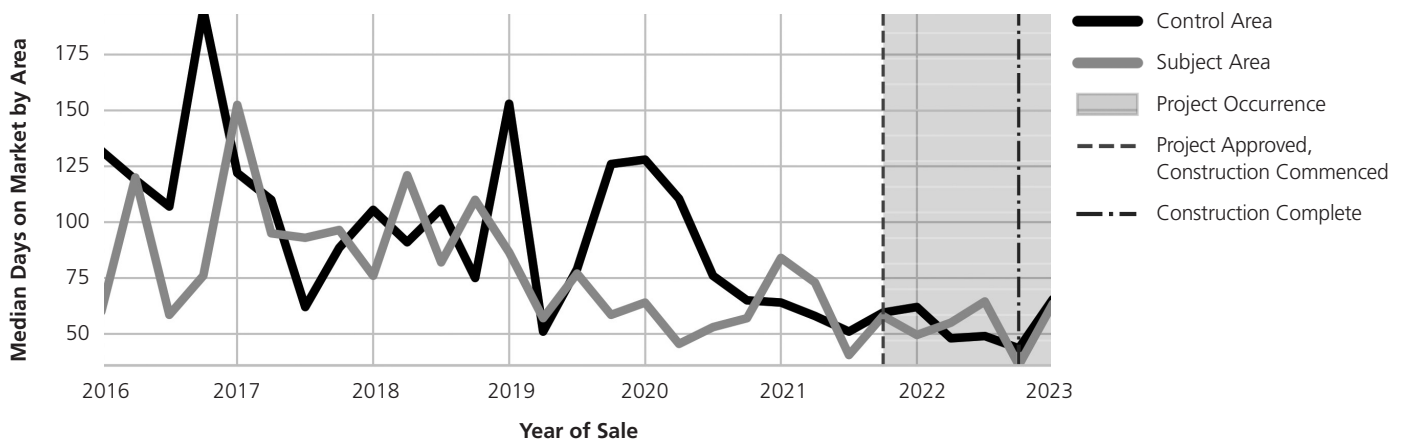


Exhibit 13 Sale Price-to-List Price Ratios for the Subject and Control Areas for the Concho Valley Solar Facility

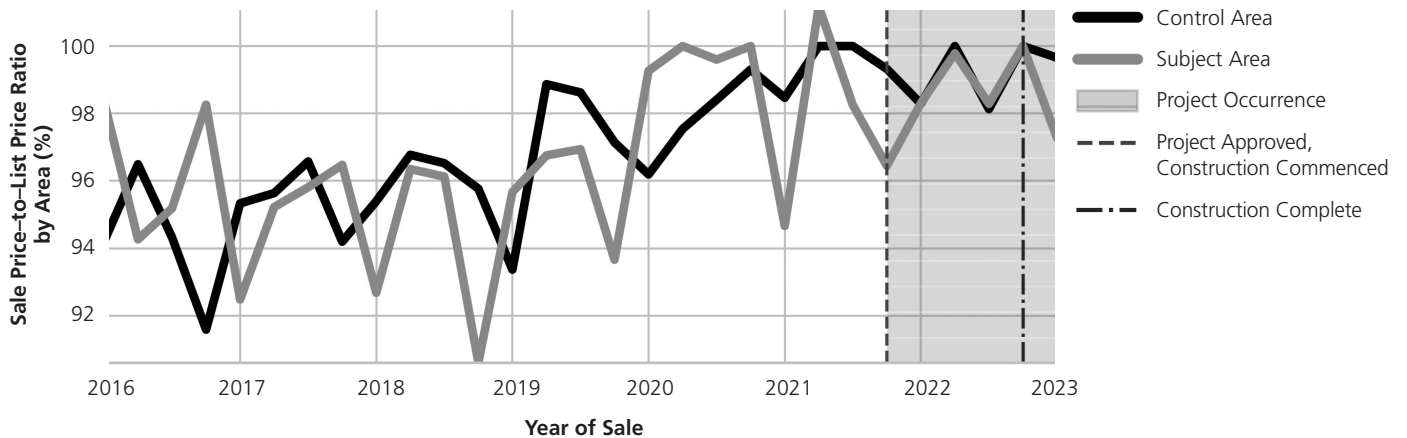


Exhibit 14 Map of Individual Sales Near the Concho Valley Solar Facility



Note: 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 white.

sale occurred after the Concho Valley Solar project announcement and tax abatement approval but before construction of the project began. The seller was the listing agent. While confirming the marketing period of the transaction, the seller indicated that the project had no effect on the sale.²⁰ In 2022, two homes sold on Countryside Road in close proximity to the Concho Valley Solar facility during the construction period. 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 that the 71 days on market was faster than the typical marketing time for homes selling in the \$900,000 range.²¹ The agent stated that the property sold closer to the date it was listed. 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 that the project had not affected the sales they have been a party to, nor have buyers shown concern.²² 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.²³ The map in Exhibit 14 shows the location of these individual sales relative to the Concho Valley Solar project, outlined in white.

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 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. These 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

Bell County: Five Wells Solar Facility

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 the Five Wells Solar project was submitted in July 2021 and was approved in May 2022. Construction of the project began in late 2022 and was still underway as of 2023. The Five Wells Solar project comprises approximately 8,000 acres and will have a solar production capacity of 350 MW.

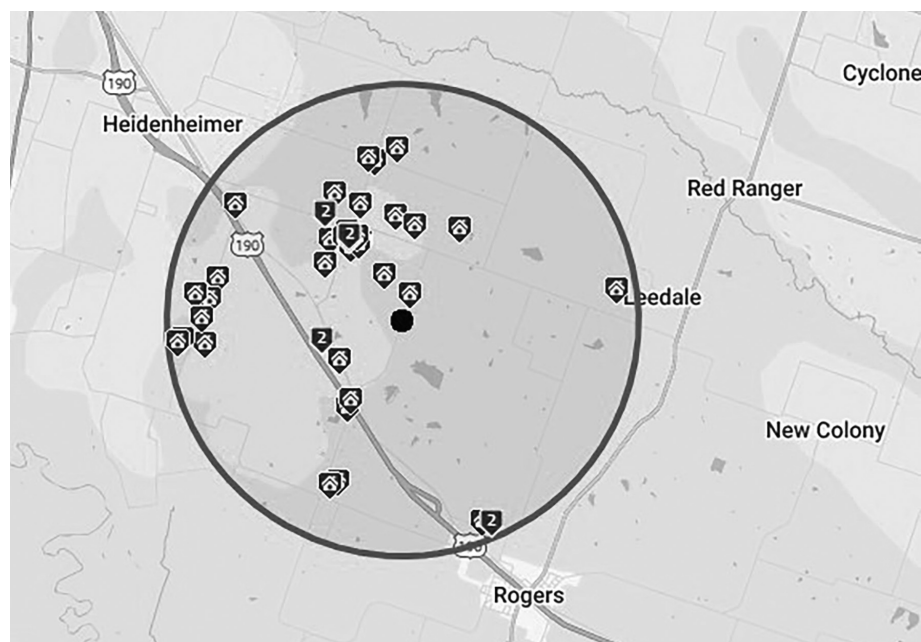
20. Conversation with agent involved with the sale on May 30, 2023.

21. Agent indicated that the typical days on market was closer to 150 days.

22. Conversation with agent involved with the sale on May 30, 2023.

23. Conversation with agent involved with the sale on March 5, 2023.

Exhibit 15 Sales from January 2018 to March 2023 within a Three-Mile Radius of the Five Wells Solar Facility



The residential development in this area is more rural in nature as compared to the residential planned developments 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 that have a view of the Five Wells Solar facility. For the 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, and occurring between January 2018 and March 2023 (as shown in the map in Exhibit 15) 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 as 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.

Exhibit 16 graphs the median price per interior square foot for the subject and control areas. After the approval of the tax abatement and during construction of the Five Wells Solar project, the median price per interior square foot for homes near the Five Wells Solar facility has

increased significantly compared to homes farther away. Before the project was announced or construction started, prices in the area were generally lower relative to home prices further away. This reversed within a year of the project's announcement. In terms of median price per interior square foot, homes proximate to the Five Wells Solar project tend to sell for higher sale price-to-list price ratios (meaning few to no discounts or selling above the asking price).

As shown in Exhibit 17 which graphs days on market for the subject and control areas, proximate properties appeared to take longer to sell—although this was consistent for years prior to the pandemic. To better understand the cause of these longer marketing periods, realtors involved in several subject area transactions were interviewed. Exhibit 18 graphs the sale price-to-list price ratios for the subject and control areas.

The trends graphed in Exhibits 16–18 show no evidence of market impact to homes within three miles of the Five Wells Solar facility. To the contrary, subject area sale prices have been strong and improving relative to the control area sales since 2021 and in the years since the Five Wells Solar facility announcement and construction. Sale price-to-list price ratios are strong, showing an average ratio over 100% for subject area sales

Exhibit 16 Median Price per Interior Square Foot for the Subject and Control Areas for the Five Wells Solar Facility

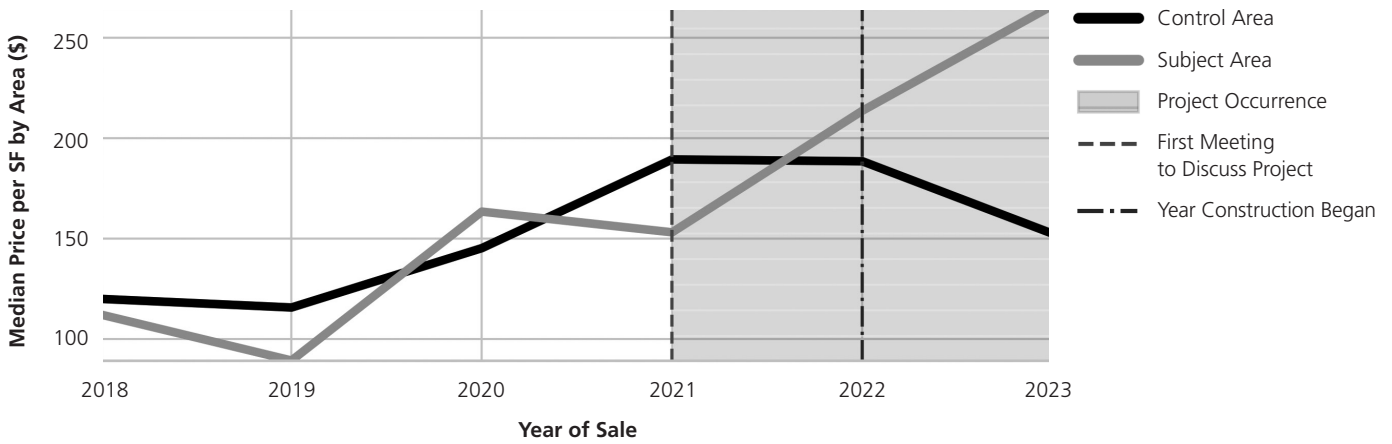


Exhibit 17 Days on Market for the Subject and Control Areas for the Five Wells Solar Facility

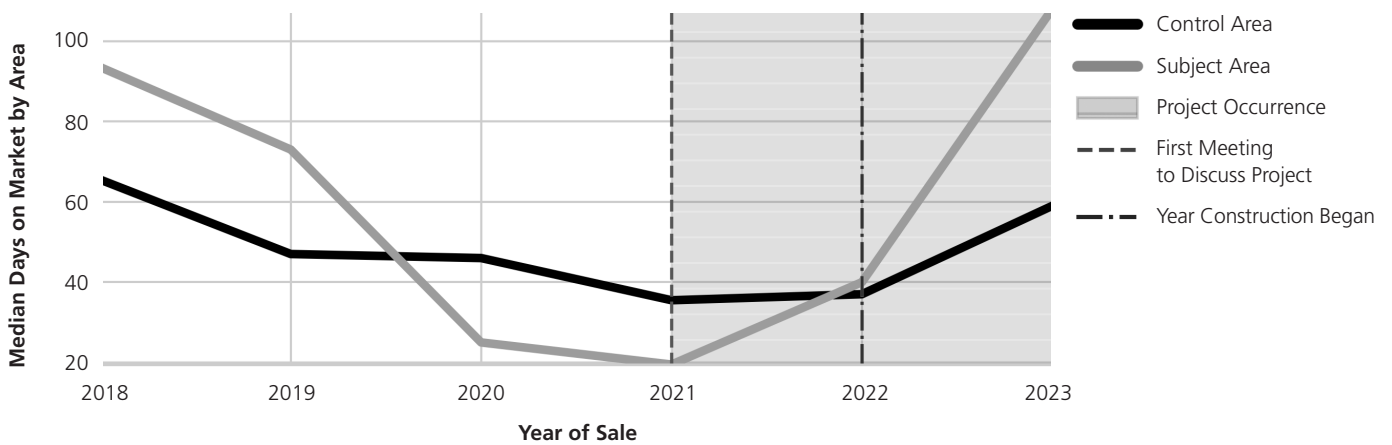
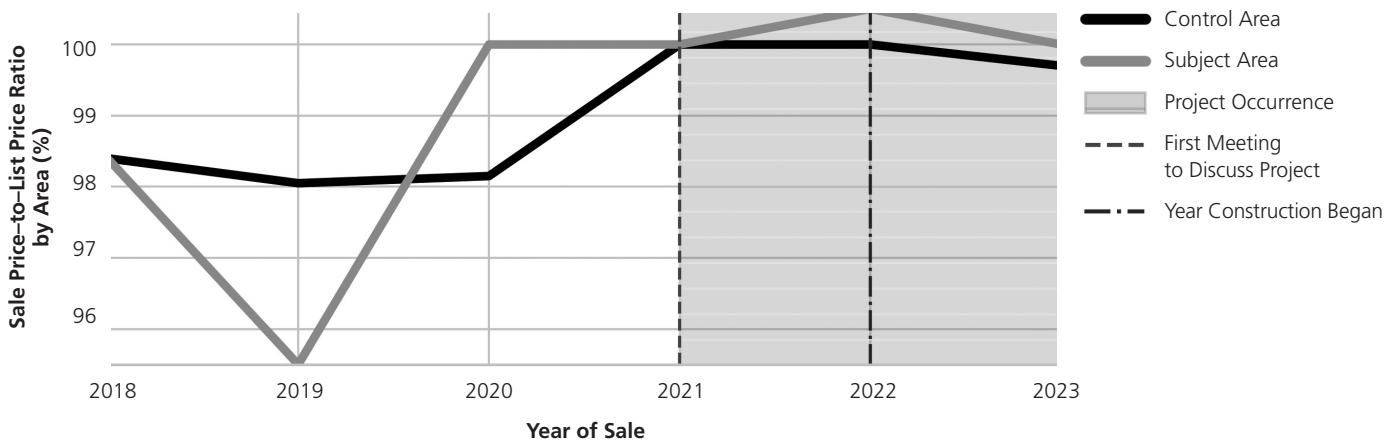


Exhibit 18 Sale Price-to-List Price Ratio for the Subject and Control Areas for the Five Wells Solar Facility



in 2022. Days on market has increased over time and relative to the control area, but conversations with realtors involved in several transactions revealed that the longer marketing period was not associated with the Five Wells Solar facility (instead attributable to factors such as a need for extensive repairs, a buyer unable to obtain financing, or the property still being under construction). During these conversations, agents stated that the project did not come up in their discussions. They have found that the market, in general, is aware of the Five Wells Solar project, and it has not affected sales.²⁴ One agent stated that they were aware of individual cases in which 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. This suggests that although widespread market impacts are not evident, individual properties in very close proximity or with a direct view of a solar project may potentially experience impacts in some areas. This reinforces the need for property-specific analysis when estimating diminution in value at an individual property.²⁵

Summary of Research and Findings

The market trend analysis of single-unit residential properties near three utility-scale solar projects in two Texas counties—in varying residential markets and at different stages of project development—showed no evidence of negative market-wide impact. The sale metrics of price per interior square foot, sale price-to-list price ratios, and days on market in subject areas follow generally similar trends when compared with control area sales located further from solar projects. These findings were consistent across the areas studied.

Similarly, published literature studying market-wide impacts in the Netherlands, England, Wales, and six states in the United States found little to no impact on residential homes proximate to utility-scale solar projects (with average impacts ranging from 0% to -5.4%). When impacts were found, the reduction in price was noted for homes

located approximately 0.5 mile or less from the solar project. One study noted that the effects of large-scale solar projects cannot be generalized, as any potential effects depend on many factors particular to individual projects or locations. Survey responses found that the visibility of a project and its size or installed capacity may affect public perception surrounding a proposed solar project.

Conclusion

Although support exists for the development of green energy in the form of large-scale solar projects, specific proposed projects are occasionally met with local opposition. Homeowners in surrounding areas may express concern regarding negative impacts to their properties due to the construction and operation of a large-scale solar project. This research was intended to address the question of whether, in general, homeowners proximate to a large-scale solar project should expect to see a drop or decline in property value.

The market trend analyses of residential homes in markets proximate to three large-scale solar projects did not provide any evidence of a negative impact on sale prices, days on market, or sale price-to-list price ratio. As noted, these findings cannot be generalized or assumed to apply to every market or solar project, as any potential impacts depend on many factors particular to individual projects and locations. For example, a home directly adjacent to a large-scale solar project and with a direct view of the solar panels may experience a unique impact compared to the overall market. However, these findings indicate that a negative impact from proximity to a large-scale solar project cannot be assumed and individual, market-specific analysis must be conducted to support any estimate of diminution in value. The market trends analyses presented here, in combination with the findings from published literature, provide evidence that market demand exists at competitive prices for residential properties proximate to a large-scale solar facility.

24. Conversation with brokers and agents involved with sales on Wedel Cemetery Road and Shaw Road.

25. Conversation with agent involved with sales on FM 2184 and Sun Circle.

The body of literature addressing the impacts of large-scale solar projects on property value is limited, and there is opportunity for future studies on this topic to refine and supplement these general findings. Additional research utilizing paired sales analyses to study specific residential properties at different proximities to the solar projects

and with differing views would add additional insight to the factors that contribute to individual impacts at specific properties. Statistical regression analysis could also be used to account for varying property characteristics such as size and age and to test for varying impacts at different proximities and for properties with differing views.

About the Authors

Erin Kiella, PhD, is executive vice president and consultant at Real Property Analytics Inc. 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 detrimental conditions, including environmental contamination or alleged contamination from on-site and off-site sources. She has expertise in statistical modeling and econometrics. 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. 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 Real Estate Center in January 2018, 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. She has lectured several courses at Texas A&M University. Kiella has a PhD in agricultural economics from Texas A&M University and a BBA 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. **Contact: erin@rpa-inc.com**

Jennifer Pitts, MAI, CRE, is the president of Real Property Analytics Inc. and has over fifteen 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 provided expert testimony on litigation matters before federal and state courts. 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. She has familiarity and experience with specialized valuation methods used in these types of assignments, including econometric and statistical modeling, paired sales analysis, and case study research. 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 is a designated member of the Appraisal Institute (MAI) and a 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 a state-certified general real estate appraiser in Texas and other states. She has coauthored several articles for *The Appraisal Journal* and *The Journal of Real Estate Literature*. **Contact: jennifer@rpa-inc.com**

Christopher Yost-Bremm, PhD, is an assistant professor of finance at San Francisco State University. 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. He 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). In addition, Yost-Bremm has provided analytic valuation services for mining and other industrial properties and has analyzed numerous other commercial and residential property types under complex economic situations, such as low-income housing tax credits, property diminution in insurance claims, transferable development rights, and partial takings in eminent domain, among other matters. In addition, through the use of complex econometric

models, he has studied the impacts of environmental contamination on income capitalization rate risk premiums and sale prices for commercial properties in Southern California and coauthored an article on this topic. He has published real estate and financial valuation work in numerous academic journals, including *The Journal of Behavioral Finance, Cities, The North American Journal of Economics and Finance, The Review of Behavioral Finance, and The Journal of Computer Information Systems*. He received the Richard U. Ratcliff Award from the Appraisal Institute, presented annually for the most outstanding original article by an academic author published in *The Appraisal Journal*, for his regression study on commercial property values amid environmental contamination. 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). He is a state-certified general real estate appraiser in California. **Contact: chris@rpa-inc.com**

Additional Resources

Suggested by the Y. T. and Louise Lee Lum Library

Appraisal Institute

- **Lum Library Online Catalog [Login required]**
Subject headings: "Energy efficiency" OR "Solar energy" AND keyword: "farm"
- **Lum Library Knowledge Base Bibliographies [Login required]**
Solar farms