Impact of Utility-Scale Solar Farms on Property Values in North Carolina

By Megan Wang

Dr. Christopher Timmins, Faculty Advisor

April 8th, 2022

Honors Thesis submitted in partial fulfillment of the requirements for Graduation with Distinction in Economics in Trinity College of Duke University

Duke
University
Durham, North Carolina
2022

Acknowledgements

This paper would not have been possible without the support of my thesis advisor Dr. Christopher Timmins, who guided me throughout the entire process. I also want to thank Yu Ma, PhD candidate in Environmental Policy at Duke University, for her advice in the data analysis portion of this study. Finally, I am grateful to my family and all my peers at Duke University who supported and encouraged me in the pursuit of this project.

Abstract

The aim of this paper is to investigate impacts of utility-scale solar farms on surrounding property values. Using data from CoreLogic, the Energy Information Administration (EIA), and the US Census Bureau, this study identifies a 12% statistically significant increase in sale values associated with high-income residential homes within three miles of a solar farm. However, low-income homes built near solar farms are associated with a -1.4% decrease in sale values.

As North Carolina continues to expand solar energy, specifically through photovoltaic utilities, understanding the impact of solar development on surrounding communities should be a priority and policies should aim to prevent property devaluations in low-income neighborhoods caused by solar farms.

JEL Classification: Q42, R11

Keywords: Solar farms, Property Values, Local Planning, Renewable Energy, Energy Justice

Introduction

Discussions about solar energy have become increasingly widespread as much of the nation's attention continues to turn toward renewable sources. In North Carolina, solar energy is an especially pertinent topic. According to the Solar Energy Industries Association (SEIA), North Carolina is ranked fourth in the nation for having the most solar installed at 7,811.21 MW, enough to power over one million homes and 8% of the state's electricity portfolio. In terms of economic impact, solar has contributed over 6,000 jobs and invested nearly $10.5 million in North Carolina (SEIA, 2021). The solar industry's strong presence in the state can be credited to North Carolina's state and regulatory policies designed to support the solar industry. For one, North Carolina's Renewable Energy and Energy Efficiency Portfolio Standard (REPS) required all municipal utilities and electric cooperatives to meet a target of 10% renewables by 2018 and have 0.2% of the state's electric power supplied by solar electric facilities (NC Clean Energy Technology Center, 2022). In 2008, North Carolina also announced it would exempt 80% of the appraised value of a solar energy electric system from property tax (NC Clean Energy Technology Center, 2021). Finally, North Carolina's Business and Energy Tax Credits provide a 35% state tax credit for renewable energy projects (NC Clean Energy Technology Center, 2019). These examples demonstrate that the state government has strongly supported solar interests in the past and allowed solar to expand its impact throughout the past decade.

Looking towards the future, solar in North Carolina is expected to continue growing. According to Governor Roy Cooper's 2019 Clean Energy Plan, which called for a 70% reduction in carbon emissions from the utility sector by 2030 and carbon neutrality by 2050, solar capacity is projected to increase by about 4,000 megawatts (MW) by 2025 (NC Department of Environmental Quality, 2019). This growth is aided by House Bill 589, also known as the Competitive Energy Solutions for North Carolina, which includes new programs for competitive renewable energy procurement, solar rebates and leasing, community solar, and specific studies related to renewable energy. Just this year, Governor Roy Cooper issued Executive Order No. 246 to reaffirm North Carolina's commitment to achieving a clean energy economy and net-zero greenhouse gas emissions by 2050 (Exec. Order No. 246, 2022). In a recent report created by the Duke University Nicholas Institute and UNC Center for Climate, Energy, Environment, and Economics, expanding solar is a necessary component to achieving these goals and decarbonizing North Carolina (Konschnik et al., 2021). All this considered, solar will likely continue to be emphasized in order to achieve the state's climate goals.

Though solar energy's environmental implications are widely known to the public, considering the economic and social impacts of implementing solar energy are just as essential. As solar technology improves and the costs of solar energy continue to decrease, it will become increasingly important to explore the potential consequences of such systems. In doing so, we can better prepare for and implement solar more equitably and efficiently.

The purpose of this paper is to explore a question that has often been discussed in the context of the potential externalities associated with solar: what are the potential impacts large-scale solar utilities, or solar farms, have on surrounding property values? By using empirical data on solar farms and house values in North Carolina, this study can help illuminate an important aspect of energy planning in an urban context as the state continues to transition to renewables.

Background

A solar farm can be defined as a large-scale solar installation of photovoltaic (PV) panels that is used to capture light from the sun and convert it to usable energy. On average, solar farms generate five MW, enough to provide electricity for 1200 homes and cut carbon dioxide emissions by 500g/kWh. A solar farm with a megaplate capacity of five MW would typically be built across 15 ha of land, with 30% of the area being covered by 20,000 solar panels (Jones, Hillier, & Comfort, 2014).

North Carolina is considered a leader in the United States for solar electric capacity, ranking fourth in the nation after California, Texas, and Florida (SEIA, 2021). Though the first solar farm in North Carolina only came into operation around 2008, the state now hosts around 335 solar entities with utility-scale solar systems (EIA, 2022). Of these entities, Duke Energy is the largest owner of solar in the state, producing about 3.7 gigawatts and operating 40 solar facilities (Duke Energy, 2021). These entities also include corporations that directly utilize solar energy—SAS has a 2.2 MW solar farm near their headquarters in Cary and Apple has 25 MW of solar capacity installed to power their data center in Maiden (EIA, 2022). In general, solar entities are major players in the expansion of solar; thus, in the discussion of solar farms' impact upon property values, it is helpful to first understand how these entities decide where to build solar farms.

When choosing a site, these solar developers go through a due diligence process that involves both offsite and onsite inspections using technology such as GIS, ALTA surveys, and Geotech surveys. Optimal sites include large stretches of clear land with limited topography but within close proximity of a transmission line. In terms of land cover types solar farms are typically developed on, they include a mix of agricultural, forested, and urban areas. The vast majority of solar energy is generated on former agricultural land (63.5%) because the land is easier to purchase or lease and does not require clearing forests in preparation (Figure 1).

Table 1: Percentage of land cover types in North Carolina and at solar utility locations

	Forest & Woodland	**Agriculture & Developed Vegetation**	**Developed & Other Human Use**	**Open Water**	**Recently Disturbed or Modified**	**Other**
NC	47.9%	20.9%	10.2%	9.4%	7.4%	4.1%
Solar Farms	12.3%	63.2%	16.7%	0.2%	7.1%	0.4%

Source: Curtis et al., 2020

However, developers may only start construction after going through the necessary permitting processes specified by the municipality that has jurisdiction over the site's territory. For North Carolina specifically, most local governments provide zoning and land use regulations but have yet to specify regulation of solar development. As of 2012, 87% of the state's municipalities and 79% of North Carolina's counties had adopted zoning ordinances. However, only 24 cities and 18 counties instituted solar developments into their codes (NC Clean Energy Technology Center, 2016). Included as one of those cities, Raleigh's municipality has specified that solar developers must prepare non-residential permit applications for constructing in all major zoning districts (Raleigh). Huntersville also requires the issuance of Special Use Permits (Huntersville). Though the number of municipalities with solar zoning ordinances is now surely higher, solar development regulation in the state is still rather inconsistent and permitting criteria undefined. As cities are developing to refine their solar development zoning regulations, understanding the impact that utility-scale solar development has on surrounding residential zones can be informative on what to permit and what not to permit.

Current Literature

Though there is considerable research about the impacts of wind turbines, power plants, and transmission lines on property values, there has yet to be a substantial amount of literature regarding a potential relationship between solar farms and property values. The only study specific to North Carolina is from Kirkland Appraisals, which used matched-pair analyses, essentially comparing prices of properties adjoining a solar farm and similar properties further away from a solar farm. This study observes a -5% to 5% difference in square-foot sales price, a range that Kirkland considers insignificant (Kirkland, 2016).

However, of the papers that have been released about the subject generally, there already have been some important insights regarding the communities that live near solar utilities. First, some community members who live or are expected to live near solar utilities have already expressed concerns regarding solar farms' impact on property value. For example, while pushing for the approval of a solar farm in Suffolk in England, the St. Edmundsbury Borough Council noted that "concerns have been expressed over the impact on neighboring property values from the proposed solar farm" but emphasized "they are not considered to be material to the assessment of this application" (The SolarTrade Association, 2013, as cited in Jones, Hillier, & Comfort, 2014). Other examples of community members expressing concerns over solar farms negatively impacting property values have also often been dismissed largely because current literature has not found clear evidence suggesting that is the case. For example, Al-Hamoodah et al. found that few homes are likely to be impacted by solar farms (2018).

Even so, solar farms continue to experience problems with community acceptance. In one study, it was found that larger projects are less likely to receive public support. Other factors such as trust in the “owners” of the project, land access and habitat preservation concerns, government involvement, and cost perception all affect community acceptance (Carlisle et al, 2015). In another study, it was found that each successive year taken to plan for installing solar farms decreased the likelihood of the project’s completion by 21.5%. Thus, instead of solar farms facing more acceptance over time, solar utilities face more obstacles as planning continues. Furthermore, it was found that a unit increase in planned installed capacity also has a negative effect on the likelihood a solar farm would be successfully implemented. In fact, each unit increase resulted in about 2.2% decrease in the likelihood of a positive outcome (Roddis et al, 2018). It is important to understand the reasoning of why communities may be unaccepting towards utility-scale solar, especially if the state hopes to continue expanding it.

These examples of “cold feet” may be influenced by preexisting beliefs people may hold against solar farms. One survey found that while 80% of respondents support solar installations in the US and even their own county, 70% of respondents believe that large-scale solar installations will decrease property values (Carlisle et al., 2015, as cited in Al-Hamoodah et al., 2018). Another study conducted by the Idaho National Laboratory found that 43% of respondents from the southwest United States agree that being able to see a large-scale solar facility from their properties would decrease their homes’ values. In the same survey, about 70% of respondents indicated that they would require the buffer zone around a solar facility to be at least one mile between the solar farms and residential areas (Idaho National Laboratory, 2013, as cited in Al-Hamoodah et al., 2018).

These concerns from community members indicate that more research should be dedicated to measuring any possible impacts solar utilities may have on surrounding property values. If negative impacts are discovered, urban planners can better use that information to implement solar more fairly. If no impacts are discovered, urban planners and renewable energy players can work to assuage community concerns.

Data and Methods

This paper uses data from the US Energy Information Administration EIA-860M, CoreLogic, and the US Census Bureau. The first dataset provides exact coordinates of all 700 operating solar photovoltaic electricity generators in North Carolina, as well as their operating years all the way up to November 2021 and nameplate capacity. The latter provides sale amounts and coordinates for North Carolina properties, as well as general characteristics of the home such as number of beds, bathrooms, and square footage. The CoreLogic data was cleaned so that it only included single-family homes with one to six bathrooms and bedrooms. Furthermore, only properties under 10 acres were used. The sold year was limited to between 2000 and 2016 to account for potential confounding variables associated with dramatic changes in the housing market over time. To account for outliers, any sale below $10,000 and the top 5% of transaction values were removed. Finally, the last data source supplied household income information to each property data point using census tract numbers.

ArcGIS was used to measure the line distance between the residential properties and their closest utility solar farm. Only properties within 10 miles of a solar farm were used. Of the cleaned CoreLogic and EIA-860M datasets, 101,700 properties were within 10 miles from a solar farm and 105 solar utilities had properties within 10 miles of them. After adding on the US Census Bureau data, 33,063 homes within the specified radius had income data. These homes preserved representation from all the 105 utilities specified above. The final dataset contained 33,063 observations and 105 solar utilities.

To explore whether the distance between a home and the nearest solar farm would significantly affect its property value, the following hedonic regression model was used:

$$\log(SV) = \alpha + \beta_1(Close) + \beta_2(SoldAfter) + \beta_3(YearBuilt) + \beta_4(SoldYear) + \beta_5(Plants) + \beta_6(Bedrooms) + \beta_7(Bathrooms) + \beta_8(Acres) + \beta_9(BuildingSqFt) + \beta_{10}(LowIncome) + \beta_{11}(Close * SoldAfter) + \beta_{12}(LowIncome * SoldAfter) + \beta_{13}(LowIncome * Close) + \beta_{14}(Close * SoldAfter * LowIncome) + \varepsilon$$

The dependent variable of interest in this model is the sale value of homes throughout North Carolina, defined as *SV*. The log of *SV* was used to interpret the change in property value as a percentage. The main independent variables under investigation are 1) the interacting variable *Close*SoldAfter* and 2) the interacting variable *Close*SoldAfter*LowIncome*. The other covariates are listed below:

- ***Close*** as a dummy variable for properties built within three miles of a solar farm
- ***SoldAfter*** as a dummy variable for properties sold after the solar farm was built
- ***YearBuilt*** as dummy variables for every decade that homes were built in the dataset
- ***SoldYear*** as dummy variables for every year that homes were sold between 2000 and 2016
- ***Plants*** as dummy variables for each solar farm (accounting for location and other variables that may impact property value that is associated with location)
- ***Bedrooms*** as dummy variables that represent number of bedrooms (only 1-6 bedrooms are represented in the data)
- ***Bathrooms*** as dummy variables that represent number of bathrooms (only 1-6 bedrooms are represented in the data)
- ***Acres*** as the size of the property in acres, limited to 10 acres
- ***BuildingSqFt*** as the size of the home itself in square feet (without yard or anything outside the physical home)
- ***LowIncome*** is defined as any household that earns $45,518 or less. This amount was calculated by averaging the low-income threshold for each county in North Carolina; this data is provided

by US Department of Housing and Urban Development. Because the sample size of high-income households is too small, middle- and high-income regions are not differentiated.

Table 2: North Carolina summary statistics

Variable	Descriptions	Mean	St. Dev.	Min	Max
Sale Value	The price at which the home is sold	125,500	60,798	10,000	309,500
Close	Marked 0 if the home is between 3 to 10 miles from the nearest solar farm and marked 1 if the home is within 3 miles from the nearest solar farm	0.322	0.467	0	1
Sold After	Marked 0 if the home is sold before the nearest solar farm is built and marked 1 if the home is sold after the nearest solar farm is built	0.078	0.268	0	1
Year Built	The year in which the home was built	1975	24.80	1750	2015
Acres	The number of acres the home occupies (both the building itself and the outside area surrounding the building)	0.686	0.957	0.010	10
Solar Farm Operating Year	The year in which the solar farm began operations	2015	2.290	2010	2021
Distance	The distance between the home and the nearest solar farm	4.796	2.621	0.076	9.975
Income	Average household income of the home's census tract	51,876	15,206	11,278	176,607
Low Income	Marked 0 if the associated household income is not considered low-income and marked 1 if it is low-income	0.386	0.487	0	1

Results

The results center around the coefficients for the interacting variables $\beta_{11}(Close * SoldAfter)$ and $\beta_{14}(Close * SoldAfter * LowIncome)$. β_{11} describes the effect solar farms would have on homes that are within three miles of a solar farm and sold after the solar farm was built. β_{14} has the added component of the home being in a low-income neighborhood. The final effect on low-income homes is reflected by taking both β_{11} and β_{14} into account ($\beta_{11} + \beta_{14}$).

These coefficients are shown in the figure below:

Table 3: Regression Table

Regression Table

	Dependent variable:
	log(sale_amount)
Close	-0.020*
	(0.009)
Sold After	0.041
	(0.021)
Close * Sold After	0.120***
	(0.028)
Close * Low Income	-0.070***
	(0.013)
Sold After * Low Income	-0.015
	(0.025)
Close * Sold After * Low Income	-0.134***
	(0.045)
Constant	15.56***
	(0.686)
Observations	33,063
R^2	0.394
Adjusted R^2	0.389
Residual Std. Error	0.484 (df = 32816)
F Statistic	86.53*** (df = 246; 32816)
Note:	*p**p***p<0.01

As seen from the figure above, the difference in property values when accounting for distance to a solar farm and whether the property was built before or after the farm is statistically significant.

Specifically, there is a positive 12% change in home value when accounting for the said variables. However, that is only the case when accounting for high-income neighborhoods; there is a -1.4% change in home values for specifically low-income regions.

Alternative specifications in regressions were also analyzed to test whether the results would still be robust. For each different regression, a different set of covariates were utilized.

Table 4: Alternative Specifications

Dependent Variable: Log(sale price)	*A*[1] *(S.E.)*	*B* *(S.E.)*	*C* *(S.E.)*	*D* *(S.E.)*	*E* *(S.E.)*	*F* *(S.E.)*	*G* *(S.E.)*	*H* *(S.E.)*
Acres	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Square Feet of Residence	Yes	Yes	No	Yes	Yes	Yes	No	Yes
Bedrooms	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bathrooms	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Plant_ID	Yes	Yes	No	No	No	No	Yes	Yes
Regions	Yes	No	No	No	No	Yes	No	No
Built Year (Dummy Variable)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sale Year (Dummy Variable)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Low Income	No	Yes	Yes	Yes	Yes	Yes	Yes	No
Home within 3 miles of solar farm	-0.020* (0.009))	-0.021* (0.009)	-0.067*** (0.009)	-0.042*** (0.009)	-0.036*** (0.009)	-0.061*** (0.009)	-0.027* (0.009)	-0.020* (0.009)
Home sold after solar farm's operation year	0.041 (0.021)	0.041 (0.021)	0.309** (0.019)	0.058** (0.018)	0.016 (0.018)	-0.270*** (0.019)	0.045* (0.022)	0.040 (0.021)
Home within 3 miles sold after solar farm's operation year	0.120*** (0.028)	0.120*** (0.028)	0.119*** (0.031)	0.089** (0.029)	0.113*** (0.029)	0.145*** (0.030)	0.113*** (0.029)	0.120*** (0.028)
Low-income home within 3 miles of solar farm	-0.070*** (0.013)	-0.069*** (0.013)	-0.224*** (0.014)	-0.149*** (0.013)	-0.142*** (0.013)	-0.219*** (0.014)	-0.087*** (0.014)	-0.071*** (0.013)
Low-income home sold after solar farm's operation year	0.015 (0.025)	-0.014 (0.025)	0.035 (0.029)	0.0003 (0.027)	0.009 (0.026)	0.041 (0.028)	-0.033 (0.026)	0.015 (0.025)
Low-income home within 3 miles of solar farm and sold after solar farm's operation year	-0.134** (0.045)	-0.135** (0.045)	-0.063 (0.050)	-0.062 (0.048)	-0.079 (0.046)	-0.066 (0.050)	-0.105* (0.046)	-0.134** (0.045)
Constant	15.56*** (0.686)	15.23*** (0.037)	15.69*** (0.037)	15.34*** (0.041)	15.07*** (0.04)	15.07*** (0.040)	15.43*** (0.037)	15.23*** (0.037)
Observations	33,063	33,063	33,063	33,063	33,063	33,063	33,063	33,256
R^2	0.394	0.392	0.212	0.297	0.294	0.236	0.365	0.393
Adjusted R^2	0.389	0.388	0.211	0.296	0.293	0.235	0.36	0.389
Residual Std. Error	0.484 (df = 32816)	0.484 (df = 32819)	0.550 (df = 33019)	0.519 (df = 33016)	0.522 (df = 33209)	0.542 (df = 33018)	0.495 (df = 32819)	0.484 (df = 32818)
F Statistic	86.53*** (df = 246, 32816)	87.21*** (df = 243, 32819)	207.1*** (df = 43, 33019)	303.3*** (df = 46, 33016)	300.1*** (df = 46, 33209)	231.2*** (df = 44, 33018)	77.54*** (df = 243, 32819)	87.24*** (df = 244, 32818)
Note:	*p**p***p<0.01							

In alternative regressions B, G, and H, the results were significant for both interaction variables of interest. Interestingly, these regressions specify the solar farms that the properties are closest to, suggesting that there may be specific characteristics about the solar farms that may influence surrounding property values: location, size of the solar farm, or age. Because they follow the trend specified in the

[1] Original regression

original regression, they reaffirm the results presented above and the original regressions appears robust. However, more research should be done investigating whether specific characteristics of solar farms impact property values differently.

Discussion

The results show that we need two explanations to describe the results: one to explain why there is a positive impact on property values in middle- and high-income neighborhoods, and another to explain why there is a negative impact on low-income neighborhoods.

In explaining the positive impact on neighborhoods, there may be some parallels between price premiums often associated with solar panels or hybrid cars and an increase in property values after a solar farm is built. There have been multiple studies that have identified examples of "conspicuous conservation," or a consumer behavior in which typically high income, college-educated households are willing to invest in visible "green" options because it signals a "green" social status. In Bollinger et al., they discovered that the visibility of solar panels from the street positively affected solar adoption at distances of at least 500 meters (2019). This suggests that because homeowners understood that their solar panels would be seen by those passing by, they were more likely to build solar panels on their roofs. Another study by Sexton identified a willingness to pay in the range of $430-$4200 for a Toyota Prius because it provided a "green signal" (2013). Finally, Dastrup et al. identified a 3.5% premium associated with solar panels. The premium was estimated to be even larger in communities with majority college graduates and registered hybrid vehicles (2012).

A limitation of this idea in the context of solar farms is that both solar panels and Toyota Prius are obviously visible signals. Solar farms, on the other hand, are not as clearly visible both to surrounding properties as well as passersby. Thus, though the idea of "conspicuous conservation" may be associated with solar panels and hybrid vehicles, it does not provide a perfect parallel to solar farms.

In terms of explaining why solar farms may have a negative impact on low-income households' property values, there could be several potential explanations. For one, it may be a similar phenomenon as wind farms decreasing surrounding property values. In a study by Sunak, it was found that proximity to a wind farm causes significant negative impacts on nearby property values in Germany (2013). While there was a lack of evidence that the visibility of the wind turbines or shadow flickering affected property values, there was evidence that properties sold after the construction of the wind farm had lower values than properties sold before construction. If parallels can be drawn between wind turbines and solar farms, then perhaps the construction of the solar farms may have some impact on property values. However, more research is needed on this subject.

Potential ways to mitigate solar farms' negative impacts on property values should involve community members in planning and development processes. One study by Devine-Wright found that greater public engagement in the decision-making processes can increase public approval (cited in Carlisle et al., 2015). However, much like the previous explanation, more research is needed on this issue in order to better understand potential vulnerabilities and more effective solutions.

Conclusion

This paper aims to explore the potential impact solar farms have on nearby home values. Analyses of data from the EIA and North Carolina property values show that solar farms are generally located in ZIP codes with lower property values. When considering the needs of solar farms, this pattern makes sense: solar farms need flat and uninterrupted expanses of land, as well as areas with existing electricity infrastructure, which more commonly house lower-income residents (Roddis et al, 2018). However, hedonic regressions show that these properties are also associated with decreasing home values if within proximity of a solar farm.

These results show that potential negative impacts from solar farms will be felt only by lower-income homeowners. The growing number of solar farms being built in the United States only emphasizes the urgency of understanding this relationship. Just last year, Duke University partnered with a solar energy developer in North Carolina in attempts to reach their carbon neutral goals by 2024 (Duke, 2020). Though this decision is an important move in decreasing carbon emissions, it may also cause the unintended consequences of encouraging the construction of solar farms near residential areas, thus decreasing the property values of impacted neighborhoods. These results emphasize the continuing need to clarify the impacts solar farms have on surrounding communities.

References

Al-Hamoodah, L., Koppa, K., Schieve, E., Reeves, D. C., Hoen, B., Seel, J., & Rai, V. 2018. "An Exploration of Property-Value Impacts Near Utility-Scale Solar Installations." Retrieved from emp. lbl. gov/sites/default/files/property-value_impacts_near_utility-scale_solar_installations. pdf.Idaho National Laboratory. 2013. "PVMapper: Report on the Second Public Opinion Survey. Prepared for the U.S. Department of Energy. https://inldigitallibrary.inl.gov/sites/sti/sti/5935850.pdf

Bollinger, B., Gillingham, K., Kirkpatrick, A. J., & Sexton, S. (2019). Visibility and Peer Influence in Durable Good Adoption. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3409420

Carlisle, J. E., Kane, S. L., Solan, D., Bowman, M., & Joe, J. C. (2015). Public attitudes regarding large-scale solar energy development in the U.S. *Renewable and Sustainable Energy Reviews*, *48*, 835–847. https://doi.org/10.1016/J.RSER.2015.04.047

Dastrup, S. R., Graff Zivin, J., Costa, D. L., & Kahn, M. E. (2012). Understanding the Solar Home price premium: Electricity generation and "Green" social status. *European Economic Review*, *56*(5), 961–973. https://doi.org/10.1016/J.EUROECOREV.2012.02.006

Devine-Wright, P. (2007). Reconsidering public attitudes and public acceptance of renewable energy technologies: a critical review. Architecture, Working Pa(February), 1–15. https://www.researchgate.net/publication/228419338

Duke. (2020). "Historic Solar Deal Powers Duke University Toward Carbon Neutrality." Retrieved from https://today.duke.edu/2020/08/historic-solar-deal-powers-duke-u-toward-carbon-neutrality

Duke Energy (2022.). Duke Energy begins construction on largest solar plant in Surry County, N.C. Retrieved April 8, 2022, from https://news.duke-energy.com/releases/duke-energy-begins-construction-on-largest-solar-plant-in-surry-county-n-c

EIA, (2022). Preliminary Monthly Electric Generator Inventory (EIA-860M) [Data set]. EIA.

Exec. Order No. 246, (Jan 7, 2022), https://governor.nc.gov/media/2907/open

Huntersville Municipality. (n.d.). Zoning Ordinance. Retrieved April 8, 2022, from https://www.huntersville.org/595/Zoning-Ordinance

Idaho National Laboratory. 2013. "PVMapper: Report on the Second Public Opinion Survey. Prepared for the U.S. Department of Energy. https://inldigitallibrary.inl.gov/sites/sti/sti/5935850.pdf

Jones, P., Hillier, D., & Comfort, D. (2014). Solar farm development in the United Kingdom. *Property Management*, *32*(2), 176–184. https://doi.org/10.1108/PM-05-2013-0032

Kirkland, R. C. J. (2016). Grandy Solar Impact Study. https://www.southripleysolar.com/wp-content/uploads/2020/09/Kirkland-Grandy-Solar-Impact-Study.pdf

Konschnik, K., Ross, M., Monast, J., Weiss, J., & Wilson, G. 2021. "Power Sector Carbon Reduction: An Evaluation of Policies for North Carolina." Nicholas Institute for Environmental Policy Solutions. Retrieved from https://nicholasinstitute.duke.edu/sites/default/files/publications/Executive-Summary-from-Power-Sector-Carbon-Reduction-An%20Evaluation-of-Policies-for-North-Carolina.pdf

North Carolina Department of Environmental Quality (DEQ). 2019. "North Carolina Clean Energy Plan". Retrieved from https://files.nc.gov/governor/documents/files/NC_Clean_Energy_Plan_OCT_2019_.pdf

NC Clean Energy Technology Center. (2013). Template Solar Energy Development Ordinance for North Carolina. www.snl.com/InteractiveX/Article.aspx?cdid=A-17930699-11303

NC Clean Energy Technology Center. North Carolina Solar Policies. Mar. 2017, www.townofchapelhill.org/home/showdocument?id=35072#:~:text=State%20law%20requires%20all%20investor,from%20eligible%20sources%20by%202018.

NC Clean Energy Technology Center. (2022, March 24). Renewable Energy and Energy Efficiency Portfolio. https://programs.dsireusa.org/system/program/detail/2660/renewable-energy-and-energy-efficiency-portfolio-standard

Raleigh Municipality. (n.d.). Commercial Solar Photovoltaic (PV) System. Retrieved April 8, 2022, from https://raleighnc.gov/permits-and-inspections/commercial-solar-photovoltaic-pv-system#paragraph--348236

Roddis, Phillipa, et al. "The Role of Community Acceptance in Planning Outcomes for Onshore Wind and Solar Farms: An Energy Justice Analysis." Applied Energy, vol. 226. https://doi.org/10.1016/j.apenergy.2018.05.087

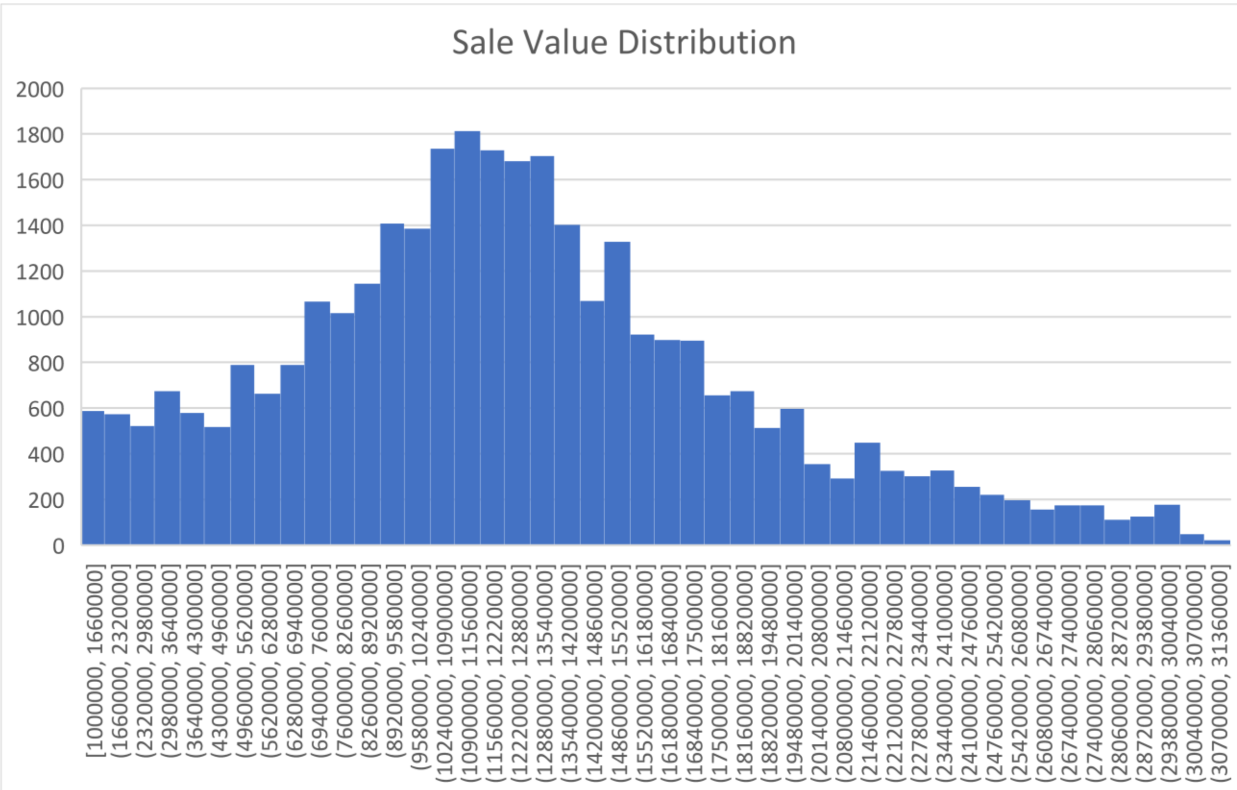
SEIA. "North Carolina Solar." SEIA, 2021, www.seia.org/state-solar-policy/north-carolina-solar.

Sexton, S. E., & Sexton, A. L. (2014). Conspicuous conservation: The Prius halo and willingness to pay for environmental bona fides. *Journal of Environmental Economics and Management*, *67*(3), 303–317. https://doi.org/10.1016/J.JEEM.2013.11.004

Sunak, Y., & Madlener, R. (2012). The Impact of Wind Farms on Property Values: A Geographically Weighted Hedonic Pricing Model, FCN Working Paper No. 3/2012, Institute for Future Energy Consumer Needs and Behavior, RWTH Aachen University. *FCN Working Paper*, *3*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2114216

Appendix

A. Distribution of Sale Values



B. Multicollinearity Test for Hedonic Regression

	GVIF	Df	GVIFDf))
Close	2.558	1	1.599
Sold After	4.474	1	2.115
Built Year	4.593	9	1.088
Sale Year	22.256	16	1.102
Baths	2.223	5	1.083
Bedrooms	2.046	5	1.074
Acres	1.256	1	1.121

Building Square Feet	2.241	1	1.497
Plant	257.794	200	1.014
Low Income	1.920	1	1.386
Close * Low Income	3.284	1	1.812
Close * Sold After	2.698	1	1.643
Sold After * Low Income	2.516	1	1.586
Close * Sold After * Low Income	2.626	1	1.620

Because the *GVIFDf* measurement for all the variables are under 5, multicollinearity was not detected.