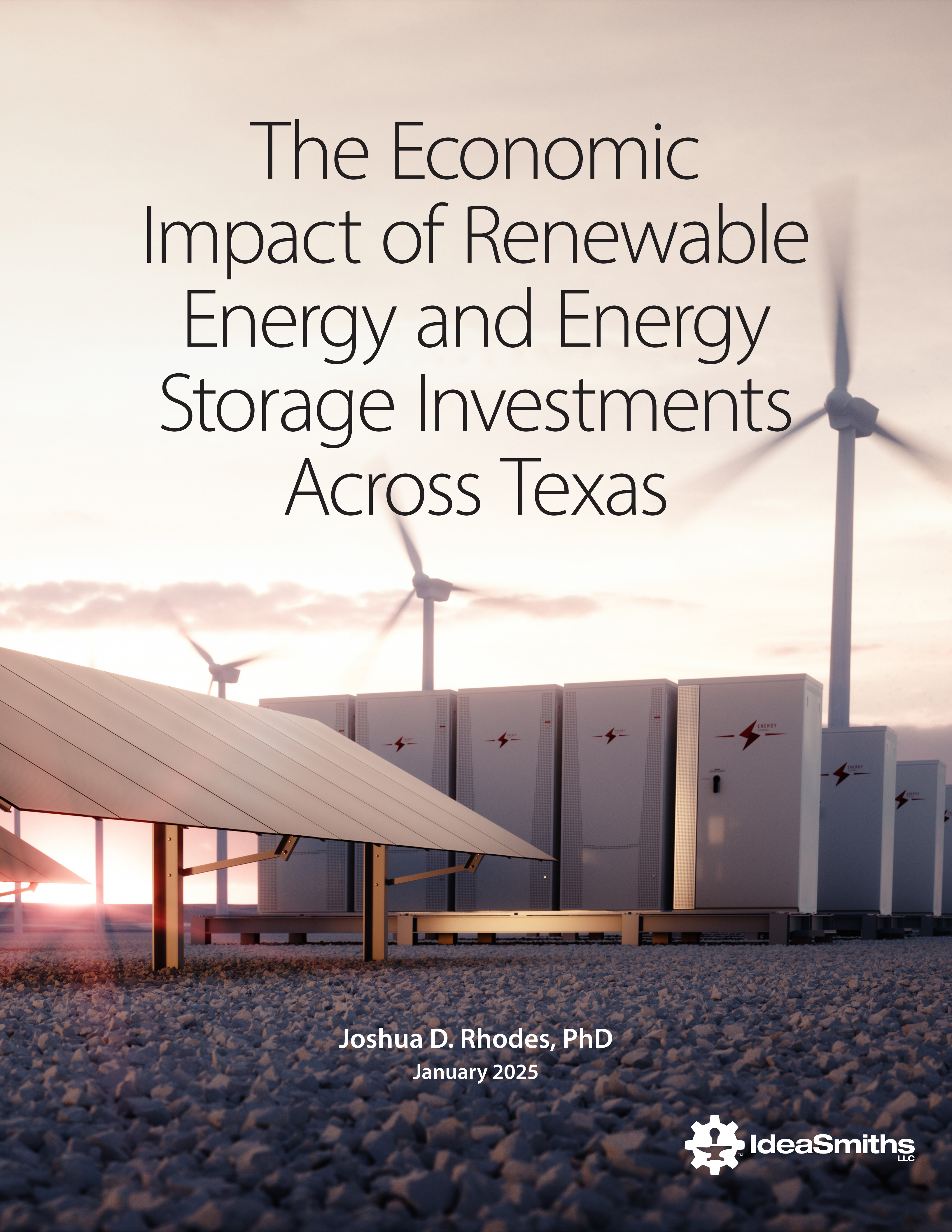
The Economic Impact of Renewable Energy and Energy Storage Investments Across Texas



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Contents

Executive Summary

This analysis assesses many aspects of utility-scale wind, solar, and energy storage investments in Texas, including local tax collections, landowner payments, and the local sentiment surrounding these projects. We find that:

- Renewables are a large, and growing, source of tax payments and revenue for landowners across Texas.
- Residents and community leaders indicated that counties with renewable energy and storage projects tend to see them as good neighbors.
- Elected county leaders look favorably on renewable energy projects for the planning stability that comes with having confidence in consistent long-term revenue streams.
- The growth of renewables has been a significant source of revenue for local jurisdictions and landowners across Texas, and any policy changes that reduce renewable or storage deployment in Texas will reduce these benefits, which are a lifeline to many rural communities across the state.
- The current and expected fleet of renewables and energy storage is expected to pay almost $50 billion in lifetime landowner payments and local taxes.
- Over their lifetime, the current fleet of utility-scale wind, solar, and energy storage projects in Texas are estimated to generate about $12.3 billion in new tax revenue to local communities.[1]
- If all projects with executed interconnection agreements[2] are built, we estimate that *existing and expected* utility-scale wind, solar, and energy storage projects will pay about $20.2 billion in total tax revenue over their lifetimes.
- Existing utility-scale wind, solar, and energy storage projects in Texas are estimated to pay Texas landowners about $15.1 billion over the lifetime of the projects.
- If all projects with signed interconnection agreements are built, we estimate that Texas landowners will directly receive more than $29.5 billion over the *existing and expected* project lifetimes.
- Over 75% of Texas counties are expected to receive tax revenues from either wind, solar, or energy storage projects.

1 For aggregate values in this report, wind and solar projects were estimated to have a 30-year lifetime and current energy storage projects were estimated to have a 15-year lifetime.

2 For the purposes of this report, we define projects with executed interconnection agreements as "expected" projects.

Introduction

This report is an update to a previous version[3] that assessed the taxes and landowner payments paid by wind, solar, and energy storage projects. This report builds on the previous analysis by updating estimates of the local taxes and landowner payments that wind, solar, and energy storage will make over their lifetimes.[4]

By their very nature, rural counties tend to depend more on agriculture and have fewer people and less industry per area than other regions. This arrangement is desirable for many Texans, but higher levels of ag-exempt land mean smaller tax bases, which can strain the budgets of rural counties. This strain is compounded by the fact that rural counties are often large in land area and have many miles of roads to maintain to be able to provide essential services to their residents. In Texas, these areas have recently become the focus for renewable energy and energy storage development given their abundant resources and available space. This report seeks to assess the financial benefits that renewables have and are expected to bring to these rural areas.

The purposes of this report are two-fold:

1. to estimate the levelized (per MW) stream of tax and landowner payments that flow into counties in Texas when utility-scale wind, solar, and energy storage projects are built; and
2. to provide some perspective from some of the residents of those areas. Funds flowing into counties from renewable energy projects typically consist of two major forms: increased tax revenue and direct landowner payments. Renewable and energy storage projects also provide other economic benefits to local communities via local jobs, community support, charitable contributions, and additional spending on local services such as hotels, food, supplies, and more, but these secondary economic benefits are not included in this analysis.

Chapter 313 of the Texas Tax Code, also known as the Texas Economic Development Act, which expired at the end of 2022, allowed large capital projects in Texas to seek temporary value limitations on the ad valorem assessments upon which their property tax liabilities were calculated. The program was replaced in 2023 by the Jobs, Energy, Technology, and Innovation Program, which did not include renewable energy projects in the list of eligible applicants.

Many operating wind and solar projects in Texas qualified for 313 value limitations, sometimes referred to as "abatements", during the program's life. The wind and solar tax revenue estimates (abated and unabated) are based on the analysis of Chapter 313[5] disclosures publicly available on the website of the Texas Comptroller of Public Accounts, and a methodology to extend those estimated taxes beyond the 15-year window they provide.

Estimations of local taxes from energy storage projects used private data provided by multiple companies that have built or are building energy storage projects in the state because those types of projects never qualified for Chapter 313 tax abatements and therefore their data are not public like those for wind and solar projects. Models are used to estimate landowner payments as those contracts are not publicly available and thus, we relied on input from energy law firms and developers themselves.

This analysis and the underlying methods (see Appendix A) indicate that the current fleet of wind, solar, and energy storage projects in Texas will provide roughly $12.3 billion in taxes over their lifetime and, if all projects with interconnection agreements are built, existing and expected wind, solar, and energy storage projects will pay about $20.2 billion in lifetime taxes. We also estimate that existing wind, solar, and energy storage projects in Texas will pay Texas landowners about $15.1 billion over the lifetime of the projects.

Further, if all projects with signed interconnection agreements are built, those projects will generate an additional $14.4 billion, for a total of more than $29.5 billion that is paid directly to Texas landowners.

Discussions with residents and community leaders in rural areas indicated that inhabitants of counties with renewable energy projects tend to see them as good neighbors and look favorably on them for the planning stability that comes with having confidence in consistent long-term revenue streams. Landowners with renewables and energy storage systems appear to be happy with the payments provided and the ability for projects to seamlessly fit in with the local economy. Even landowners that do not have wind turbines, solar panels, or batteries benefit from either hosting supporting infrastructure such as transmission substations and all benefit from the additional local tax revenues.

3 https://www.ideasmiths.com/s/Economic-Impact-of-Renewable-Energy_JAN2023.pdf

4 For aggregate values in this report, wind and solar projects were estimated to have a 30-year lifetime and current energy storage projects were estimated to have a 25-year lifetime.

5 Tax abatements available to large commercial projects of many types in Texas.

Renewables and Energy Storage in Texas

Texans often like to remind others that the state has the distinction of being the only state in the Continental United States to have once been its own country. If that were still the case, Texas would rank 4th in the world for installed wind capacity[6], with more than 46,500 MW inside the state's borders[7] by the fall of 2024. Further, wind is expected to increase to over 52,600 MW by 2027. At the same time, Texas was 9th in the world[8] for solar power capacity at 27,210 MW,[9] with plans to surpass 68,500 MW[10] by 2028. Texas currently has almost 10,000 MW of energy storage online and is expected to more than triple that in the next three few years.[11] These numbers do not include distributed energy resources, such as rooftop solar panels, of which ERCOT estimates there are over 115,000 distributed solar array installations[12,13] in its service territory. As a US state, Texas is currently ranked first in both wind and utility-scale solar and is on track to be the nation's leader in energy storage capacity soon.

The Electric Reliability Council of Texas (ERCOT), which serves about 90% of Texas' electricity demand (load), generated about 28% of the electricity that Texans consumed (in ERCOT) through Q2 2024 using wind power, second only to natural gas for the second year in a row. Solar power provided about 10% of total ERCOT energy through Q2 2024, and that share is expected to continue to grow quickly during the next few years. Figure 1 shows a spatial view of the existing utility-scale solar, wind, and energy storage facilities, aggregated by county, in Texas.

Texas continues to build a variety of new power generation assets with plans for new natural gas and potentially new nuclear and geothermal facilities, but wind and solar projects constitute most of the new power plants recently built in Texas and that capacity is expected to continue to grow. As of November 2024, there were more than 155,600 MW of solar projects, 35,300 MW of wind projects, and 156,700 MW of energy storage projects in some stage of the ERCOT grid interconnection process. It's important to remember that not all projects in interconnection queues get built, but Figure 2 shows a spatial view of the already existing and queued (with signed interconnection agreements) utility-scale wind, solar, and energy storage projects, aggregated by county, in Texas.

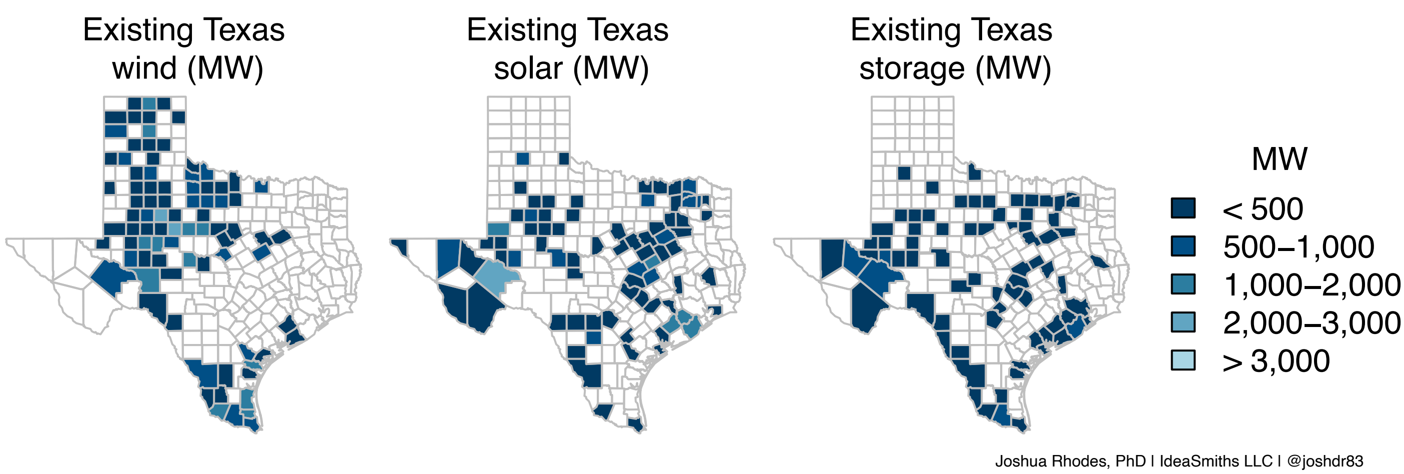


Figure 1: Figure showing the existing capacities of wind, solar, and energy storage, by county (Data from ERCOT MORA reports and EIA 860 data).

6 https://en.wikipedia.org/wiki/Wind_power_by_country

7 https://www.energy.gov/sites/default/files/2022-08/land_based_wind_market_report_2202.pdf

8 https://en.wikipedia.org/wiki/Solar_power_by_country

9 https://www.eia.gov/electricity/data/eia860/

10 Based on projects with signed interconnection agreements.

11 https://www.ercot.com/misdownload/servlets/mirDownload?doclookupId=1057263687

12 https://www.ercot.com/mktinfo/loadprofile (Profile Type Counts)

13 Wind and solar facilities designed to provide power to mainly on-site locations are exempt from property taxes. https://comptroller.texas.gov/taxes/property-tax/docs/96-1569.pdf

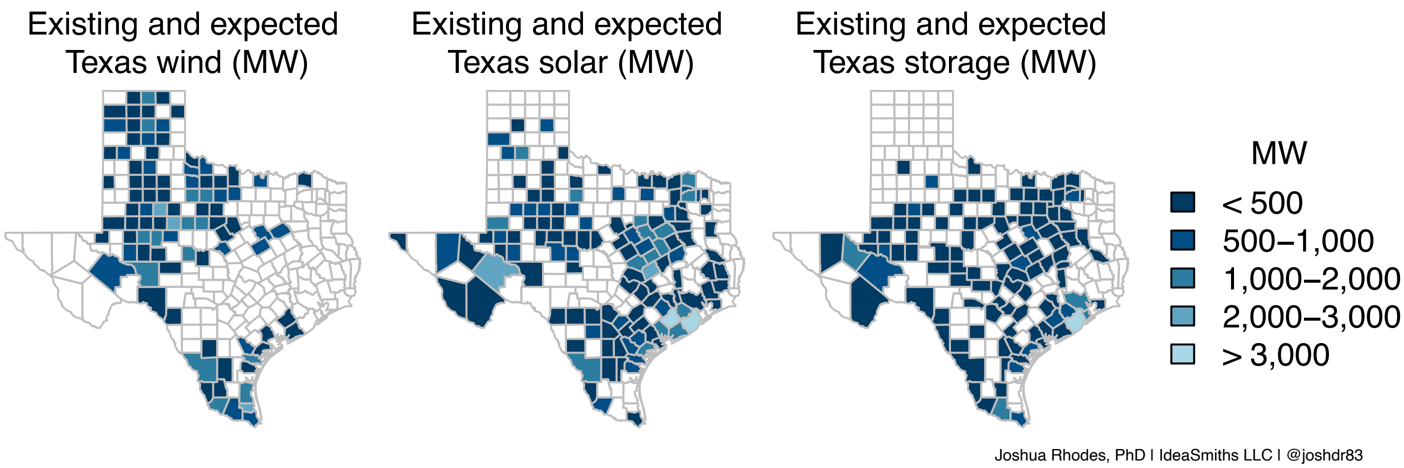


Figure 2: Figure showing the existing and expected capacities of wind, solar, and energy storage by county (Data from ERCOT MORA reports, ERCOT GIS reports[14], and EIA 860 data).

While Texas still had a statutory Renewable Portfolio Standard (RPS) that requires power companies in the state to install 10,000 MW of renewables by 2025, the requirement was exceeded in 2012, and the state has since surpassed it seven times over. Texas has been a leading energy state for more than a century, and the rapid growth of renewables and energy storage continue that legacy.

County Tax Revenue

Renewable and energy storage projects can be a major source of revenue for counties and schools, especially for rural counties that generally have a smaller tax base than others. This analysis sought to develop a systematic way to estimate the levelized (per 100 MW installed) tax revenue (including those with tax abatements) that a county might expect to receive for a project within its borders.

For wind and solar projects, we utilized publicly available Chapter 313 filings from the Texas Comptroller's website, which layout tax schedules for projects seeking the abatement as well as what they would pay without one. While this analysis assumed that most, if not all, existing projects received a tax abatement, we only applied abated tax levels to future projects that had abatements filed with the Texas Comptroller. For energy storage projects we asked for the annual project financials from companies that have or are building projects in the state. The methodology for each can be found in Appendix A.

Using the methodology refined for this analysis, we estimate that a county in Texas could expect to receive $9.4–$13.1 million in abated lifetime taxes (including school taxes) and $13.5-$18.8 million in unabated taxes for a 100 MW solar project located in its boundaries, $16.8–$20.3 million (abated) and $19.7-27.9 million (unabated) for a 100 MW wind project, and $3.8–$4.7 million for a 100 MW energy storage project.[15] Using the average of these estimates, Figure 3 shows our estimated amount of the lifetime taxes to be paid in each county for existing wind, solar, and energy storage projects (left) and if all wind, solar, and energy storage projects with interconnection agreements[16] are built (right) in millions of dollars.

14 Projects with signed interconnection agreements only.

15 Note that these values do not include Payments in Lieu of Taxes (PILOT) payments that are sometimes also paid directly to local jurisdictions and thus could be an underestimation of the total payments that some projects make.

16 An Interconnection Agreement; can include either of the following, 1) the Standard Generation Interconnection Agreement (SGIA), 2) a Public financially binding agreement, or 3) an official letter from a Municipally Owned Utility (MOU) or Electric Cooperative (EC) signifying developer intent to build and operate generation facilities and interconnect with the MOU or EC .

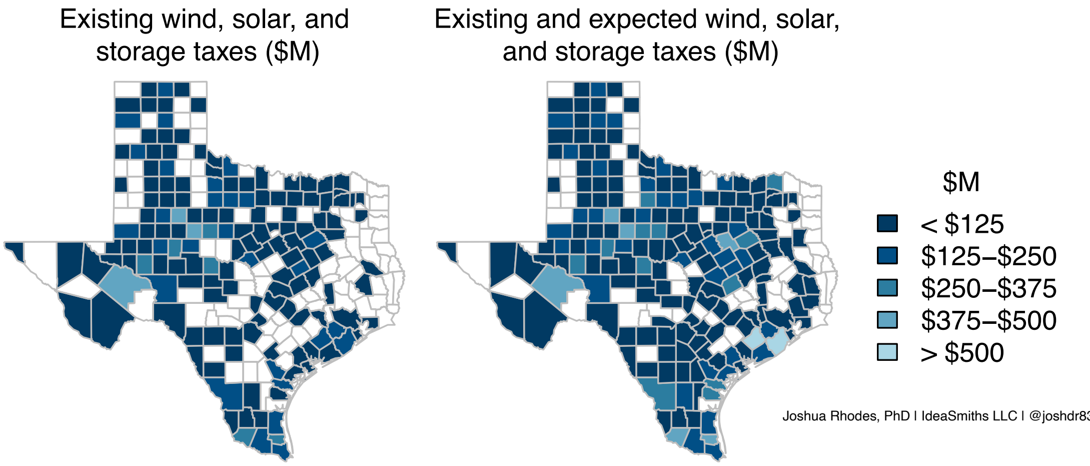


Figure 3: Figure showing our estimates of the amount of taxes to be paid in each county for existing wind, solar, and energy storage projects (left) and if all projects with interconnection agreements are built (right) in millions of dollars. Average between the low and high tax values were used to create the figures.

Summing the values for each county indicates that existing wind, solar, and energy storage projects in Texas will pay about $12.3 billion in taxes over their lifetime and, if all projects with interconnection agreements are built, existing and expected wind, solar, and energy storage projects will pay about $20.2 billion in lifetime taxes. When these projects are built, 192 of 254, or over 75% of Texas counties will be receiving tax revenues from renewable energy or energy storage projects.

Landowner Payments

A second stream of payments from renewable and energy storage projects are those made directly to the landowner for leasing their land to project developers. These payments can be difficult to estimate because the contracts themselves are not public. Values often vary depending on location as some properties will have a higher opportunity cost than others, i.e. higher opportunity cost land located close to population centers will often command a higher price than more marginal scrub land located far away. Landowner payments, particularly for wind, can also vary depending on the production profiles of the wind farm output. For example, wind farms in South and Coastal Texas often have higher landowner payments because they often produce more energy during times of higher grid electricity prices than those in North and West Texas.

Due to limits on the availability of data, estimates for landowner payments were made using information received from developers and energy law firms that often represent landowners in renewable energy and energy storage development contracts. Landowner payment tied to contracts for photovoltaic (PV) solar farms are often simply based on the amount of acreage utilized and paid on a $/acre-year basis, like other forms of land-leasing, such as cattle grazing fees. Energy storage projects follow a similar model.

Landowner payment contracts for wind are often more complex as more of the land remains available for other uses, such as farming crops and raising livestock, after the construction phase of the project is over and during the wind farm's operation. Thus, wind landowner payment contracts often are based on the amount of physical infrastructure remaining on the property, such as the number of turbines, length of roads, and transmission rights-of-way, etc.

It is possible that landowner payment contracts can include some amount of revenue sharing based on production. However, conversations with industry representatives indicate that, while it was sometimes part of earlier contracts, it is less typical today, and most agreements use fixed or escalating values that are based on installed capacity or acreage leased. More detail is available in Appendix A.

For this version of the report, landowner payment estimates were updated using more recent data from law firms that are active in lease negotiations on behalf of landowners or project developers. These revised estimates were applied to projects with in-service dates of 2024 or later. We present the revised values here, but the values applied to earlier projects can be found in Appendix A.

Wind Landowner Payments in Texas

Using the methodology developed for this analysis, we estimate that a landowner in West Texas could expect to collect $16.4–$24.1 million[17] in lifetime landowner payments for a 100 MW wind farm located on their property, depending on the length of the contract. We estimate that the same wind farm located in the Southern and Coastal regions of Texas would provide the landowner with $23–$33.3 million in payments over its lifetime.

Solar Landowner Payments in Texas

Next, we estimate that a landowner in the West, Far West, North, and Panhandle regions of Texas could expect to collect $17–$36.5 million in lifetime landowner payments for a 100 MW solar farm located on their property, depending on the length of the contract. We estimate that the same solar farm located in the South, South Central, East, and North Central regions of Texas could expect $19.8–$41 million and landowners in the Coastal Region of Texas could expect $22.7–$45.6 million. These lease values vary because the value of the land being leased varies based on its opportunity cost of other uses.

Energy Storage Landowner Payments in Texas

Finally, we estimate that a landowner leasing their land for energy storage projects could expect to receive about between $1.2–$6 million (per 100MW) of lifetime landowner payments for a co-located energy system and about $2--$12 million per 100MW for a stand-alone energy storage system. While these numbers might seem smaller relative to that of wind and solar projects, it is important to remember that energy storage projects take up much less land per MW of capacity and these projects are generally expected to have shorter lifetimes, although they could be repowered for extended lifetimes like wind and solar projects.

Figure 4 shows our estimates of the amount of landowner payments to be made in each county for existing wind, solar, and energy storage projects (left) and if all projects with interconnection agreements are built (right), in millions of dollars.[18]

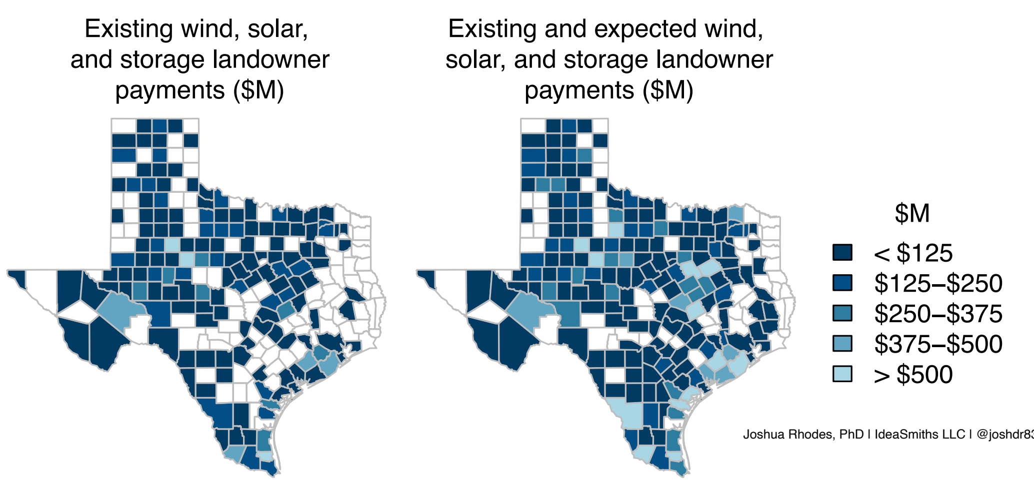


Figure 4: Figure showing our estimates of the amount of landowner payments to be made in each county for existing wind, solar, and energy storage projects (left) and if all projects with interconnection agreements are built (right), in millions of dollars. Average between the low and high landowner payment values were used to create the figures.

All together, we estimate that existing wind, solar, and energy storage projects in Texas will pay Texas landowners about $15.1 billion over the lifetime of the projects. If all projects with signed interconnection agreements are built, we estimate that those projects will generate an additional approximately $14.4 billion in lifetime landowner payments, for a total of about $29.5 billion.

Projects with interconnection agreements only constitute a view out for the next few years – the most distant project in that category is expected to come online in 2028.

17 Based on a lease length of 25 to 35 years. Some leases are longer, up to 50 years. However, as those contracts are not public and older wind farms are often being repowered with newer technology, potentially introducing new contract terms, it was not possible to estimate the length of any landowner contract. Thus, a shorter range of times were chosen for the estimated range.

18 An average of the low and high estimates in each region was used to create the figure.

However, longer-term projections see even more renewable energy capacity being built in the state so it is expected that future values of taxes and landowner payments will be higher than those outlined in this report.

Note that, while this section only focuses on the payments made to landowners for hosting solar PV panels, wind turbines, and batteries other landowners can benefit from payments for hosting the supporting infrastructure such as electric lines and substations, but that is beyond the scope of this work.

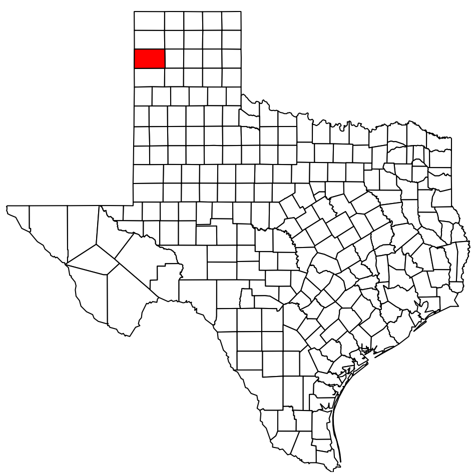
Interactive Website Presenting Project Data

The data presented in this analysis are also available at *txrenewables.net*, where users can see and download project size, tax, and landowner payment data on a statewide or regional basis, including multiple jurisdictions including counties and state and federal legislative districts.

Selected Rural County Profiles

This section of the report focuses on a handful of rural counties in Texas to assess how renewable energy has impacted local communities.[19]

Oldham County



Oldham county (population approximately 2,112) straddles many lines: it stands on the (slightly disputed[20]) border between Texas and New Mexico and the border between two of the three major grids in the US, the Electric Reliability Council of Texas (ERCOT) and Eastern Interconnect via the Southern Power Pool (SPP). In fact, it appears to be the only location where two different grids (ERCOT and SPP) share the same transmission poles, but just the poles – Oldham's Spinning Spur 1 wind farm sends power to SPP on one side while the wires on the other side carry power from Spinning Spur 2 and Spinning Spur 3 to ERCOT.

Oldham County, which at one point was almost wholly contained within the three million-acre XIT Ranch, is a very rural county where wind energy development has had a major positive impact. The vast majority of Oldham County land carries an agricultural exemption, which limits the amount of revenue that the county and the four school districts can collect for road maintenance and education, including retaining good schoolteachers. Before the wind industry arrived, Oldham County's tax base was about $248 million, and the tax rate was $0.76 per $100 of assessed value which equates to $1.9 million in total taxes to operate the county for one year.

As of 2019, the Oldham County tax base has increased to $342 million mainly due to a wind facility now fully on the tax roll. The other five facilities are still in abatement but provide $790,000 annually in PILOT payments (payments in lieu of taxes) to the county as revenue for the abatement. The tax rate has been reduced by about $0.33 to $0.50 which provided $1,710,000 and $790,000 PILOT money for a total of $2.5 million plus other revenues to provide services. While these figures may seem small in comparison to larger counties, this represents a tremendous increase for Oldham County, which allows their elected leaders the opportunity to provide more services to their residents while cutting the tax rate. Wind energy is providing meaningful and dramatic property tax relief to the citizens of Oldham County.

In the best of times, oil and gas revenues have made up approximately 20% of Oldham Counties' operating budget, but economic fluctuations and the unpredictability of global commodity price cycles make those payments hard to rely upon. In 2020, according to former County Judge Don Allred, Oldham County had lost 80-90% of its oil and gas revenues over the prior 10 years. He notes that the sector's boom and bust cycle made it difficult to rely on the indus-

19 All of the following direct quotes are from personal communication with the quoted.

20 https://en.wikipedia.org/wiki/Oldham_County,_Texas#Border_Dispute_with_New_Mexico

try for making long-term plans, but that the long-term nature of wind projects and their contracts make them a stable source of important tax revenue.

> *"Wind has been a Godsend – it allows flexibility in budgeting by providing a constant source of revenues that you know will be there when you need them."*
>
> — Don Allred, Former Oldham County Judge.

Today, about 50% of Oldham County's revenues come from wind. And, because of the agreements that school districts can make with wind farms, three out of the four school districts in the county have been able to hold bond elections approving funds to build new facilities and improve the quality of local education. Three-quarters of the revenue provided to fund these new school facilities can be attributed directly to the wind industry.

Judge Allred says that there have been no real complaints, and the wind industry has been a good neighbor, which is what small communities look for when new industries come to town. Along with increased revenues, the industry has attracted new residents to the area to stay, while not putting a burden on the existing infrastructure like other industries tend to do.[21]

Nolan County

Nolan County (population approximately 14,700) is in some ways the posterchild county for renewables in Texas. Nolan County currently has more wind capacity installed than any other county in the state, with 1,400+ turbines (~2,400 MW). Nolan County received some of the first utility-scale wind farms in Texas due to their great wind resource and eager embrace for the industry. Being an early-adopter paid off in that a significant number of wind-industry jobs, roughly 250, are now based out of Sweetwater, Texas – the Nolan County seat.

Since 1998, taxable property values in Nolan County have increased from about $608 million to almost $2.2 billion in 2018, with market values increasing to more than $3.2 billion. When asked what Nolan County would be like without the wind industry, Ken Becker, the former Executive Director of the Sweetwater Enterprise for Economic Development Municipal Development District (SEED MDD) says: "It is hard to tell, we would probably be doing something else, but it would be tougher than it is today."

Many landowners have benefitted directly from having wind farms on their land as it has added an income stream that is compatible and complimentary with their existing operations.

> *"The cows love wind turbines, they walk around them all day and follow the shadows that they cast. We now have good roads on our land [because of the wind farm] that make it easier to take care of our cattle. It [my experience with the wind industry] has been super… It is not perfect, but I wish we had more of them [wind turbines] on our land…"*
>
> – Louis Brooks Jr., Louis Brooks Ranch, LTD.

Increased tax revenues can benefit all residents of any county through better services and/or reduced property taxes. However, landowners that don't have wind turbines themselves can also benefit from the associated infrastructure, such as roads or electric infrastructure needed to support the industry. Miesha Adames is one such landowner that, while not having any wind turbines on her family ranch, has greatly benefited from the siting of a CREZ line substation.

> *"I wouldn't have been able to keep my land in the family if it were not for the landowner payments associated with the wind farms and their supporting infrastructure."*
>
> – Miesha Adames (Executive Director, SEED MDD)

21 Some other industries, in particular oil and gas extraction, while bringing in a high level of temporary jobs, often put significant strain on the local infrastructure.

Bee County

When people talk about renewables in Texas, most think of the vast ranches that span the western part of the state. While most projects have been built west of US Interstate Highway 35, the southern and coastal regions of Texas are growing as well. Bee County (population approximately 34,000), which is named after a one-time Republic of Texas Ambassador to the United States, Barnard E. Bee Sr., is in the Coastal Bend region of Texas, an area that has excellent wind resources that are most productive during periods coinciding with peak demand for electricity. This analysis anticipates more than $130 million in additional tax revenue to come from renewables and energy storage in the county.

Former Bee County Judge Stephanie Moreno, who, during her term, was the youngest female county judge in Texas is an avid supporter of increasing economic development in Bee County. She played a pivotal role in landing Bee County's first wind farm.

Local school districts have already been able to lower their tax rates by almost 10%[22] partly due to renewable investments and potential future projects could see those rates fall even further[23]. Moreno admits that there is resistance from some to real economic development of any type in rural areas like Bee County, but there is an active contingent of young couples that want to see the area grow.

> *"My husband works out of town Monday through Thursday because there aren't enough opportunities here just like my father when I was growing up. I want to live and raise my kids in Bee County. I want there to be good jobs in town so that more families can have dinner together and there are not so many missed t-ball games."*
>
> – Former Bee County Judge Stephanie Moreno

Local businesses have benefited from the under-construction 250 MW Helena Wind Farm and potential future projects, including local construction companies who can hire locals who often drive west across the state to work in the Permian.

Local ranch owners also see the benefit to the way that renewables can integrate themselves into the existing rural economy.

> *"Wind energy sales produce a passive income that does not materially interfere with the AG operations or other uses of the property. In times of drought, electric power sales continue to create rainfall-independent financial stability like the oil and gas sector provided for so many other ranchers… The developer's infusion of fresh capital will give our economy the time it needs to recover [from losing the county's largest employer and COVID-19]."*
>
> – Michael Manning, Bar T-Black Angus Ranch

Angelina County

When most people think of Texas, East Texas probably isn't the first image that comes to mind. The stereotypical Texas landscape—dry deserts, scrubland, and cacti—is far from what defines this part of the state. East Texas is instead characterized by its lush rivers, native hardwood forests, and towering stands of loblolly pines, which can often exceed 100 feet in height. But this region has a rich history of energy production. In fact, Angelina County (population approximately 87,319) is where the state's first commercially producing oil well was drilled. The county also played a pivotal industrial role in developing the East Texas Oil Field, which helped power the Allies to victory in World War II.

Although much of Texas's oil and gas production has shifted westward, renewable energy is now making its way east. The 180 MW Azalea Springs Solar Park, located just outside Lufkin, Texas, is one of the first utility-scale solar projects in this region.

22 https://www.mysoutex.com/beeville_bee_picayune/news/s-tisd-drops-tax-rate-12-cents/article_91e0392e-d632-11e9-8ef9-5f5f031c989e.html

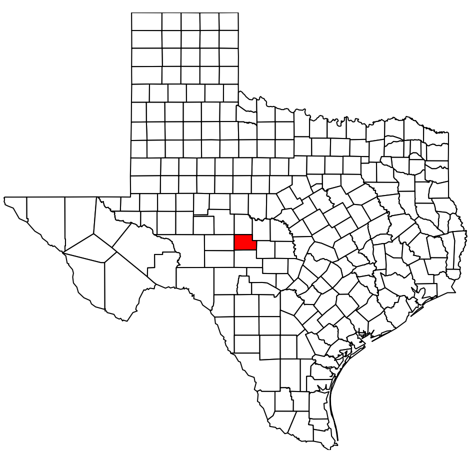
23 https://www.mysoutex.com/beeville_bee_picayune/news/s-tisd-board-oks-tax-abatement-for-wind-farm/article_086ce40e-a0ed-11ea-9526-83730477254a.html

Justin Risner, Superintendent of the Central Independent School District (whose motto is "All In") – where the solar project is located – explains his proactive approach: "I knew they were going to build the project, and I wanted our community to benefit from it." He praised the developer for their collaborative efforts, noting that the company has returned several times to ask what investments would best serve the community.

Risner shared how the annual payments from the solar farm have already been reinvested into the district and community. These funds have allowed the school to add bleachers, construct a greenhouse for the 8th-grade agricultural program (which also includes community garden plots), and launch a childcare program to attract and retain teachers and staff—a critical step in addressing the ongoing shortage of educators.

Dr. Michael Davis, former Superintendent for Cushing ISD in neighboring Nacogdoches County and now a school finance specialist with the Region 7 Education Service Center, applauded the growth of renewables in East Texas. "It's great to see these types of projects coming to our region," he said. "For smaller, rural schools, the added revenue can make a significant difference – especially for funding enrichment and construction projects that might otherwise be out of reach."

Menard County



Menard County (population approximately 1,958) is about as central Texas as you can get as the county sits only about 50 miles from the true geographic center of the state. Legend has it that Jim Bowie once held claim to half of a silver mine in Menard that some said contained a mother lode of silver ore worth billions in today's dollars. While the mine has yet to be rediscovered, other ways of gleaning wealth from the land have.

Former Republican Texas State Representative John E. Davis, who served in the Legislature from 1999 to 2015. and his brother Keith run the family's Stony Lonesome Ranch in Menard – of which he says that the name speaks for itself, the ranch is "both stony and lonesome".

At first, the brothers turned down wind developers three times thinking that it wasn't worth it. The fourth time, they sought the counsel of their father who was a retired Shell landman who asked "Well, are they paying money for it?" Upon reflection, the brothers came to realize that it was actually pretty good money and decided to take the offer. And just like that, as Davis says, the Davis family "struck wind!"

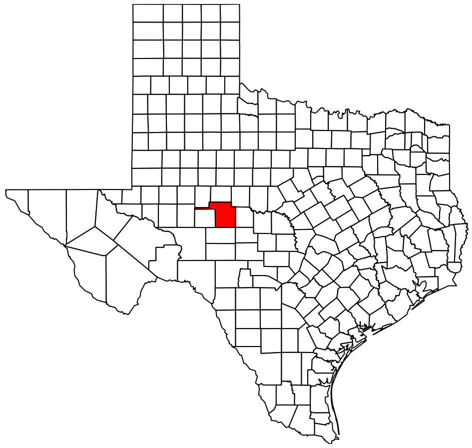
While the brothers had struck oil once before, that well only flowed for 30 days. But the Cactus Flats Wind Farm, located on the Stony Lonesome Ranch, has been spinning out energy (and income) for over seven years now and the nature of wind energy power contracts, and the earth's winds, mean it will continue to provide power and income for years to come.

The extra income from the wind turbines has had a big impact on the ranching operations, all in very good ways. The revenue has allowed them to invest in a better fence and guardian dogs that have helped keep the coyotes at bay. Before the increased investment, John said that he: "might only get 20 lambs per 100 sheep per year, but now I regularly am able to get 140!"

Mr. Davis also says that he has appreciated the infrastructure improvements provided by the wind farm operator, saying that he can "make it clear across the ranch in just a few minutes along the same path that used to take me twenty." It has also resulted in less wear and tear on his vehicles, not having to drive over such rough roads as before.

Stepping back, he also thinks that it is great being a part of the energy expansion happening in the US. He has also seen that his wind turbines are a great way to introduce kids to energy and get them thinking about the future, of which he says "It's rewarding to see these turbines not only power our communities but also spark an interest in STEM for rural kids. They're learning that they, too, can be part of this energy expansion, innovate and shape the future."

Tom Green County



Tom Green County sits right at the middle of the transition that Texas makes from the rolling plains to the famous Edwards Plateau. You can get some pretty serious change in elevation driving from the eastern part of the county to the western edge – an edge the goes on for farther than most. As one moves west it is not just the elevation that changes, but the character of the land itself – while the eastern part of the county is flush with farmland fed by the Concho River, the western side is much higher, drier, and scrubby, which makes it harder to make a living from.

Michael Looney, the VP of Economic Development at San Angelo Chamber of Commerce and volunteer fireman says: "The western part of the county is challenging, even for grazing, given the lack of water, trees, and how rocky the terrain is. However, we have three massive solar farms that have been able to make it work."

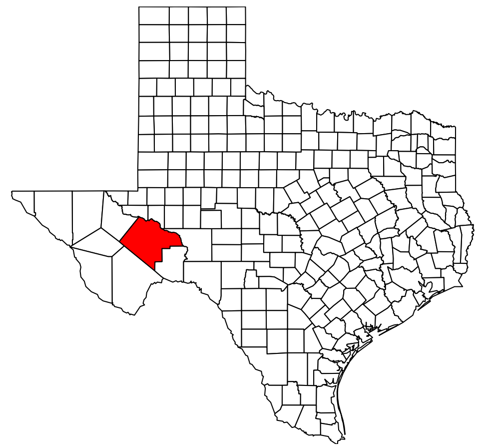
Allen Gully, who farms over 3,000 acres on the edge of San Angelo, the county seat of Tom Green County, was proactive in getting a 160 MW solar farm set up on 620 acres including two of his neighbors. He said that some folks were concerned that he was taking farmland out of production, but he said: "The truth is that the sheep that graze on the grass that grows under the solar panels are more agriculturally productive than the dryland cotton I used to run on it!" He went on to say that the panels actually cause more grass to grow because they create a dripline of condensation in the mornings and that means more food for the sheep.

He further points out that solar has been a smart hedge against the multi-year drought that the region has been it, a hedge he wishes he had more space to expand by building more solar.

Looney says that some folks criticize renewables because they don't create jobs – a claim which he says isn't true. He says that while it is true that a wind or solar farm won't create hundreds of jobs that a major factory will, the San Angelo area doesn't have the population to support those hundreds of jobs that would be needed. But his area can support the number of jobs that the wind and solar farms do bring, and he adds that the millions of dollars of tax revenue doesn't hurt either.

Looney noted that one solar project in the county was able to turn 1,600 acres that only yielded $1,700 in annual tax revenue (given its grazing agricultural tax exemption) into a $240 million dollar asset that puts millions into the local coffers every year.

Pecos County



Pecos County is the first of the big counties in West Texas. Pecos County's eastern border is defined by the Pecos River, like how many East Texas counties are defined by rivers. At over 4,700 square miles, Pecos County is the second largest county in Texas, second only to Brewster County to its south.

Pecos County has some of the best solar energy resources in Texas and so it is not surprising that it has been an early leader in the Texas solar rush. The county currently has the most installed solar of any Texas county with over 2,000 MW of capacity. Given its Far West Texas location and ample solar energy, it is also not a surprise that the county is also a large destination for energy storage projects using power generated in the area to serve the ERCOT grid.

While renewable energy projects have been providing residents with new diversified income streams for years, landowners, such as Former County Commissioner George Riggs are also starting to see the same from energy storage projects, which can help keep family ranches together.

> *"My family has a lot of heritage in this land, but my kids don't want to ranch, so other ways of earning income from the land are important to keeping it in the family."*
>
> – George Riggs, Pecos County Commissioner (former)

Mr. Riggs also noted that, as County Commissioner, he would see county tax revenues rise and fall with the global price of oil because oil and gas make up about 90% of the tax base in the county. However, the newer renewable energy and storage projects offer more stable sources of tax revenue which can serve to act as a hedge against higher taxes for county residents. This analysis expects renewable and energy storage to pay more than $350 million in taxes in Pecos County.

Conclusion

Renewable energy and energy storage development have made dramatic and positive economic impact in Texas, across the state, providing much-needed revenue to landowners and rural communities. The current and anticipated fleet of renewable power and energy storage projects is expected to pay almost $50 billion in lifetime landowner payments and local taxes.

Renewable energy is set to continue to grow by tens of thousands of megawatts in Texas and doing so will bring tens of billions of dollars of additional local tax revenue and landowner payments. The landowners and county officials consulted for this analysis tend to have a positive view of renewable energy and energy storage development and the stability that the industry brings, a stability that is less found in all other energy industries.

Acknowledgements

This work was funded by the Conservative Texans for Energy Innovation (CTEI)[24], the Advanced Power Alliance (APA),[25] the Solar Energy Industries Association (SEIA)[26], and the Texas Solar+Storage Association (TSSA).[27]

CTEI is a non-profit clean energy education and advocacy organization launched to promote energy innovation and clean energy policies grounded in the conservative principle of common sense, market-based solutions that allow fair competition and provide greater access to clean, affordable and reliable energy.

APA is the industry trade association created to promote the development of wind, solar and energy storage as resources that can deliver clean, reliable, affordable power for American consumers.

SEIA is the national trade association of the solar energy and storage industry. Through advocacy and education, SEIA works with its 1,200 member companies and other strategic partners to create jobs, champion the use of cost-competitive solar in America, remove market barriers, and educate the public on the benefits of solar energy

TSSA is the statewide association dedicated to the expansion of solar power and energy storage technologies in Texas. Our member companies are engaged in the development, installation, and operations of utility-scale, industrial, commercial, and residential solar and energy storage facilities and products, serving wholesale and retail customers with predictable, affordable, clean power.

The authors would also like to thank the landowners, county judges, school superintendents and other local leaders who graciously gave of their time to discuss how energy development of all types has impacted their lives and the places they call home. Lastly, we thank the energy consultants and project developers who provided data and helped inform the process flow for this analysis.

About Us

IdeaSmiths LLC[28] was founded in 2013 to provide clients with access to professional analysis and development of energy systems and technologies. Our team focuses on energy system modeling and assessment of emerging innovations, and has provided support to investors, legal firms, and Fortune 500 companies trying to better understand opportunities in the energy marketplace.

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24 https://www.conservativetexansforenergyinnovation.org/

25 https://poweralliance.org/

26 https://seia.org/

27 https://txsolarstorage.org/

28 https://www.ideasmiths.net/

Appendix A

County tax revenue methodology

Wind and solar local taxes

This analysis utilized the Texas Chapter 313 tax abatement filings[29] with the Texas Comptroller's office to estimate a range of taxes that solar and wind projects will pay over their estimated lifetimes. Analyzing and projecting taxes, sometimes decades into the future, is a difficult problem as many things such as lifetimes, county tax rates, appraisal values, etc. can change over time. The goal was to develop a systematic methodology to produce a range of expected taxes paid that could be reasonably applied to all existing projects and not attempt to add up all values for posted projects.[30]

Earlier versions of this report assumed that all wind and solar projects received a Chapter 313 tax abatement. However, the program was allowed to expire for wind and solar projects in 2022. While some projects that are being built or have yet to be built might still have a tax abatement in place, it is not still the case that most projects will have them. Thus, for this report we estimate taxes paid for wind and solar projects with and without abatements and apply the abated level of taxes to projects that have an existing Chapter 313 tax abatement filing with the Comptroller and apply the unabated tax estimate to those that do not.[31]

Abated Tax Calculations

This analysis took a data driven approach by first analyzing Chapter 313 tax abatement findings, specifically looking for projects with certification and economic impact packets posted online[32,33]. In each of these certification and economic impact packets, Table 4 (example shown as Figure 5 below) produces an estimation of Ad Valorem taxes to be paid for the first 15 years of the project lifetime, including abatements given. The last column produces the estimated total property taxes to be paid for the first 15 years of the project's life. Because we assume that solar and wind projects will last longer than 15 years, we developed a data-driven methodology to estimate the additional taxes to be paid for 25- and 35-year lifetimes.

29 https://comptroller.texas.gov/economy/local/ch313/agreement-docs.php

30 IdeaSmiths LLC is not a professional tax firm, nor do we employ tax experts.

31 Note that we made every effort to identify projects that had abatements filed, but it is possible that we classified some projects with abatements as those without given inconsistent project names between ERCOT and Comptroller data.

32 Example: https://assets.comptroller.texas.gov/ch313/1091/gregory-1091-apex-cert.pdf

33 We only considered projects that were wholly included within a single county and school district as developing a systematic method for keeping track of the taxes for different combinations of tax entities was beyond the scope of this analysis.

Table 4 examines the estimated direct impact on ad valorem taxes to the school district and Foard County, with all property tax incentives sought being granted using estimated market value from the application. The project has applied for a value limitation under Chapter 313, Tax Code and tax abatement with the county.

The difference noted in the last line is the difference between the totals in Table 3 and Table 4.

Year	Estimated Taxable Value for I&S	Estimated Taxable Value for M&O		Crowell ISD I&S Tax Levy	Crowell ISD M&O Tax Levy	Crowell M&O and I&S Tax Levies	Foard County Tax Levy	Foard County Hospital Tax Levy	Gateway GCD Tax Levy	Estimated Total Property Taxes
			Tax Rate*	0.0000	1.1700		0.9350	0.3187	0.0100	
2020	$ 370,580,000.00	$ 20,000,000.00		$0	$234,000	$234,000	$0	$1,181,038	$37,058	$1,415,038
2021	$ 340,987,500.00	$ 20,000,000.00		$0	$234,000	$234,000	$0	$1,086,727	$34,099	$1,320,727
2022	$ 313,761,053.00	$ 20,000,000.00		$0	$234,000	$234,000	$0	$999,956	$31,376	$1,233,956
2023	$ 288,711,408.00	$ 20,000,000.00		$0	$234,000	$234,000	$0	$920,123	$28,871	$1,154,123
2024	$ 265,664,453.00	$ 20,000,000.00		$0	$234,000	$234,000	$0	$846,673	$26,566	$1,080,673
2025	$ 244,460,006.00	$ 20,000,000.00		$0	$234,000	$234,000	$0	$779,094	$24,446	$1,013,094
2026	$ 224,950,697.00	$ 20,000,000.00		$0	$234,000	$234,000	$0	$716,918	$22,495	$950,918
2027	$ 207,000,945.00	$ 20,000,000.00		$0	$234,000	$234,000	$0	$659,712	$20,700	$893,712
2028	$ 190,486,016.00	$ 20,000,000.00		$0	$234,000	$234,000	$0	$607,079	$19,049	$841,079
2029	$ 175,291,152.00	$ 20,000,000.00		$0	$234,000	$234,000	$0	$558,653	$17,529	$792,653
2030	$ 161,310,777.00	$161,310,777.00		$0	$1,887,336	$1,887,336	$1,508,256	$514,097	$16,131	$3,909,689
2031	$ 148,447,759.00	$148,447,759.00		$0	$1,736,839	$1,736,839	$1,387,987	$473,103	$14,845	$3,597,928
2032	$ 136,612,736.00	$136,612,736.00		$0	$1,598,369	$1,598,369	$1,277,329	$435,385	$13,661	$3,311,083
2033	$ 125,723,495.00	$125,723,495.00		$0	$1,470,965	$1,470,965	$1,175,515	$400,681	$12,572	$3,047,160
2034	$ 115,704,399.00	$115,704,399.00		$0	$1,353,741	$1,353,741	$1,081,836	$368,750	$11,570	$2,804,328
			Total	$0	$10,387,250	$10,387,250	$6,430,922	$10,547,990	$330,969	$27,366,162
			Diff	$0	$28,336,151	$28,336,151	$24,514,702	$0	$0	$53,181,822

Source: CPA, Foard City Wind, LLC
*Tax Rate per $100 Valuation

Figure 5: Table 4 from the certification and economic impact document for the Foard City Wind Farm.[34]

Figure 6 shows the taxes (to be) paid as taken from Table 4 of the certificate package (solid dots, #1-15) as well as our estimated future taxes to be paid beyond those listed in Table 4 of the certificate package (hollow dots, #16-35).

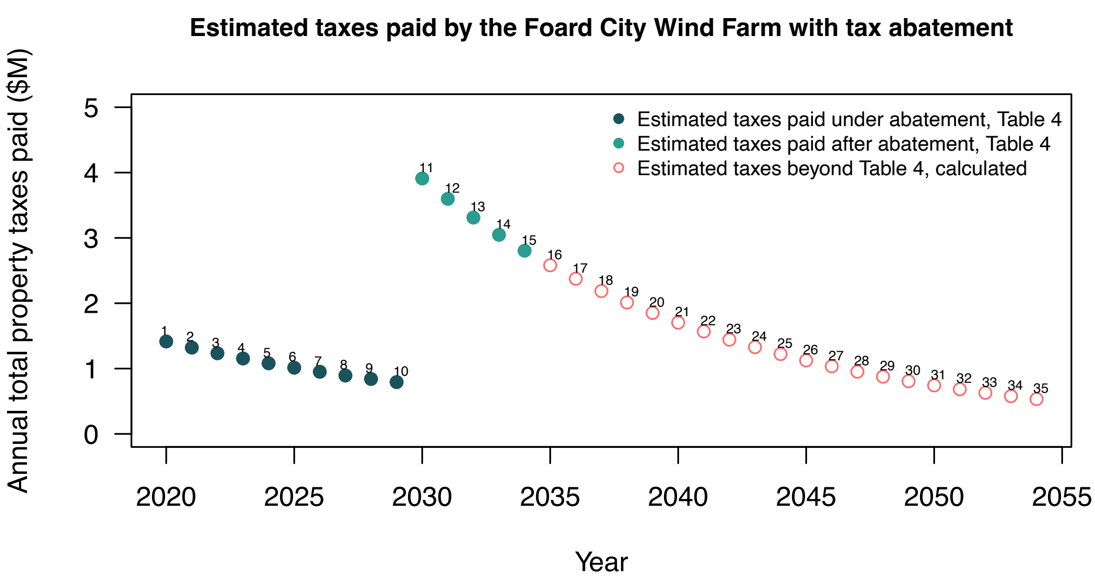

Figure 6: Ad valorem taxes paid as taken from Table 4 of the Foard City Wind Farm's Chapter 313 certificate package (solid dots #1-15) and our estimated future taxes paid (hollow dots #16-35).

34 https://assets.comptroller.texas.gov/ch313/1231/crowell-1231-foard-cert.pdf

The first ten (darker solid) dots of Figure 6 show the annual ad valorem taxes paid by the wind farm while under its tax abatement (first ten rows of the last column of the reproduced Table 4 in Figure 5). The next five (lighter solid, #11-15) dots of Figure 6 show the taxes paid after the abatement period ends (rows 11-15 of the last column of the reproduced Table 4 in Figure 5). To estimate the future taxes to be paid (#16-35 hollow dots in Figure 6), an exponential function was fit to these (lighter, solid dots #11-15) values and was used to extrapolate taxes to be paid for the next 20 years (dots #16-35).

A similar approach was taken for solar projects. However, solar farm's depreciation schedule is different than that of wind and an example of the tax schedule for a solar farm is shown in Figure 7.

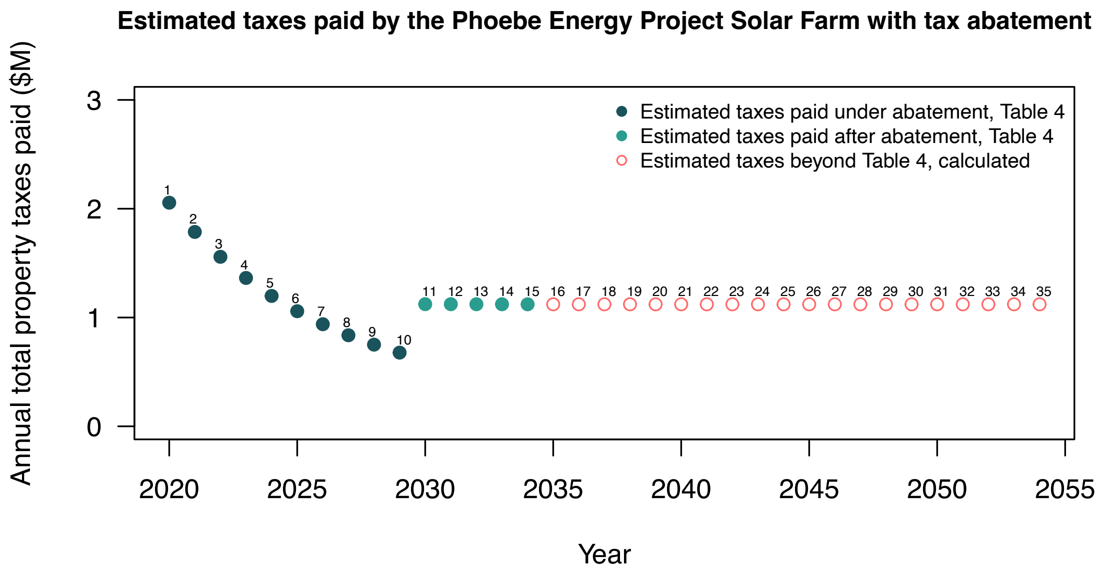

Figure 7: Ad valorem taxes paid as taken from Table 4 of the Phoebe Energy Project Solar Farm's Chapter 313 certificate package (solid dots #1-15) and our estimated future taxes paid (hollow dots #16-35).

The first ten years of Figure 7 show a similar depreciation of the solar farm's taxable value during its abatement period. Years 11-15 show a constant amount of property taxes paid.[35] To calculate the taxes to be paid in future years, this constant value was simply used for years 16-35.

A review of many of the solar and wind projects used in this analysis showed that each wind and solar project's tax schedule followed the same or a very similar pattern as the examples provided here.

Next, we developed a range of taxes paid by assuming that the project would last between 25 years for the low end and 35 years for the high end. So, for our low end estimate of lifetime taxes for a particular project, we added up the expected taxes to be paid from the last column of the project's Table 4 (example shown in Figure 5) in its certificate package and the first ten of our estimated tax payments (points/years 16-25 in Figure 6 and Figure 7).

For the higher end estimate, we included all of our estimated future years' taxes. Then, we divided the low and high estimates of total taxes paid by the capacity of the plant to get a normalized value ($/MW) of expected taxes to be paid over the project's lifetime. Lastly, to remove any outliers due to missing or incorrect data, we took the first and third quantiles of the normalized values as our low and high estimates.[36] We also attempted to assess if there were any noticeable trends in different taxes in different parts of the state but were unable to notice any recognizable patterns. Table 1 gives a summary of our estimated and levelized (per 100 MW) taxes paid over the lifetime of solar and wind projects to Texas counties.[37]

35 Tax Code Section 23.26, requires: (1) use of cost method for valuation of commercial solar assets; (2) calculation of depreciated value of property assuming useful life of not more than 10 years; and (3) prohibits appraiser from determining depreciated value to be less than 20% of the total value adjusted for physical, functional or economic obsolescence.

36 We preformed this step because there were a few very high and very low outliers in the final dataset, and we didn't want them to skew the final average results.

37 Code (R scripts) and data available on request.

Table 1: Estimated levelized (per 100MW) taxes (millions) paid over the lifetime of solar and wind projects to Texas counties with tax abatements.

Project Life	Years	25	30	35
Solar Taxes	Lifetime $M/100MW	$ 9.4	$ 11.3	$ 13.1
Wind Taxes	Lifetime $M/100MW	$ 16.8	$ 18.8	$ 20.3

One complicating factor for this type of approach is that it is possible to challenge the appraised value of any asset in future years. This is not unique to wind and solar projects but is often done for other large capital projects as well, including manufacturing facilities, oil refineries, and gas export terminals, all entities that receive the same types of tax abatements in Texas. Changing economic conditions and project size during construction can all impact future assessed values. Some of these changes are reflected in Biennial Progress and School District Cost Data Reports that are also filed on the Texas Comptroller's website.[38] An analysis of a subset of these reports did not provide a clear impact of these future assessments as some were lower and some were higher. Thus, this analysis used the values given and calculated as mentioned above to calculate the taxes paid by the solar and wind projects.

Unabated Tax Calculations

The same tax abatement filings also showed a table of future taxes that wind and solar projects would be expected to make if they did not receive the sought after tax abatement, an example of which is shown in Figure 8.

Table 3 examines the estimated direct impact on ad valorem taxes to the region if all taxes are assessed.

Year	Estimated Taxable Value for I&S	Estimated Taxable Value for M&O		Crowell ISD I&S Tax Levy	Crowell ISD M&O Tax Levy	Crowell M&O and I&S Tax Levies	Foard County Tax Levy	Foard County Hospital Tax Levy	Gateway GCD Tax Levy	Estimated Total Property Taxes
			Tax Rate*	0.0000	1.1700		0.9350	0.3187	0.0100	
2020	$ 370,580,000.00	$370,580,000.00		$0	$4,335,786	$4,335,786	$3,464,923	$1,181,038	$37,058	$9,018,805
2021	$ 340,987,500.00	$340,987,500.00		$0	$3,989,554	$3,989,554	$3,188,233	$1,086,727	$34,099	$8,298,613
2022	$ 313,761,053.00	$313,761,053.00		$0	$3,671,004	$3,671,004	$2,933,666	$999,956	$31,376	$7,636,003
2023	$ 288,711,408.00	$288,711,408.00		$0	$3,377,923	$3,377,923	$2,699,452	$920,123	$28,871	$7,026,370
2024	$ 265,664,453.00	$265,664,453.00		$0	$3,108,274	$3,108,274	$2,483,963	$846,673	$26,566	$6,465,476
2025	$ 244,460,006.00	$244,460,006.00		$0	$2,860,182	$2,860,182	$2,285,701	$779,094	$24,446	$5,949,423
2026	$ 224,950,697.00	$224,950,697.00		$0	$2,631,923	$2,631,923	$2,103,289	$716,918	$22,495	$5,474,625
2027	$ 207,000,945.00	$207,000,945.00		$0	$2,421,911	$2,421,911	$1,935,459	$659,712	$20,700	$5,037,782
2028	$ 190,486,016.00	$190,486,016.00		$0	$2,228,686	$2,228,686	$1,781,044	$607,079	$19,049	$4,635,858
2029	$ 175,291,152.00	$175,291,152.00		$0	$2,050,906	$2,050,906	$1,638,972	$558,653	$17,529	$4,266,061
2030	$ 161,310,777.00	$161,310,777.00		$0	$1,887,336	$1,887,336	$1,508,256	$514,097	$16,131	$3,925,820
2031	$ 148,447,759.00	$148,447,759.00		$0	$1,736,839	$1,736,839	$1,387,987	$473,103	$14,845	$3,612,773
2032	$ 136,612,736.00	$136,612,736.00		$0	$1,598,369	$1,598,369	$1,277,329	$435,385	$13,661	$3,324,744
2033	$ 125,723,495.00	$125,723,495.00		$0	$1,470,965	$1,470,965	$1,175,515	$400,681	$12,572	$3,059,733
2034	$ 115,704,399.00	$115,704,399.00		$0	$1,353,741	$1,353,741	$1,081,836	$368,750	$11,570	$2,815,898
			Total	$0	$38,723,401	$38,723,401	$30,945,624	$10,547,990	$330,969	$80,547,984

Source: CPA, Foard City Wind, LLC
*Tax Rate per $100 Valuation

Figure 8: Table 3 from the certification and economic impact document for the Foard City Wind Farm .

Next, we followed a similar methodology to estimate the unabated tax payments using the data found in the tax abatement documents. Examples of the projected future taxes for a sample wind and solar farm can be found in Figure 9 and Figure 10.

38 These reports can be found on the same project page as the Certificate Packages used in this analysis to estimate taxes paid.

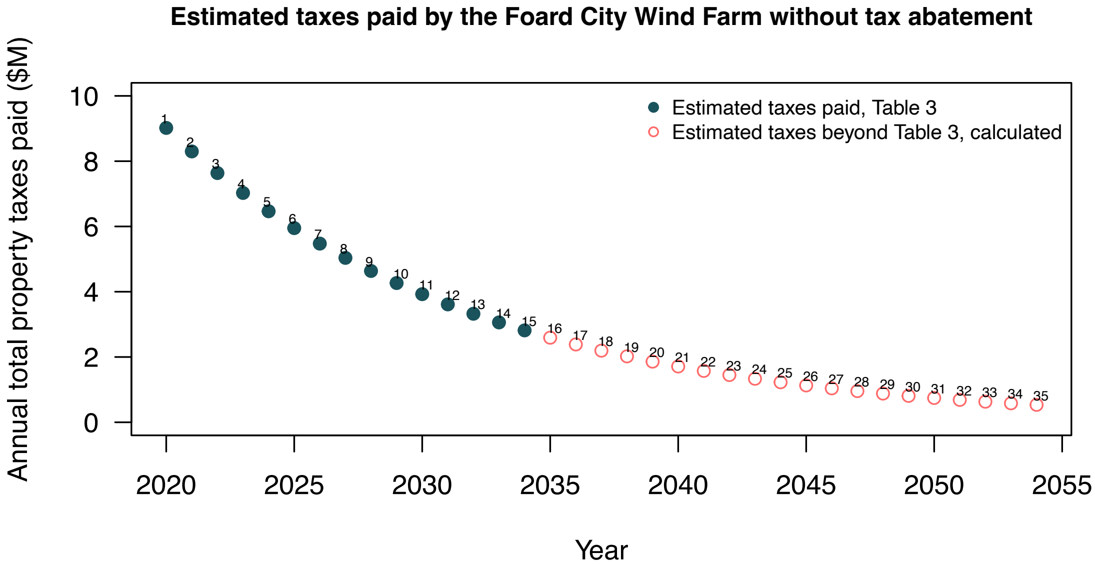

Figure 9: Ad valorem taxes paid as taken from Table 3 of the Foard City Wind Farm's Chapter 313 certificate package (solid dots #1-15) and our estimated future taxes paid (hollow dots #16-35).

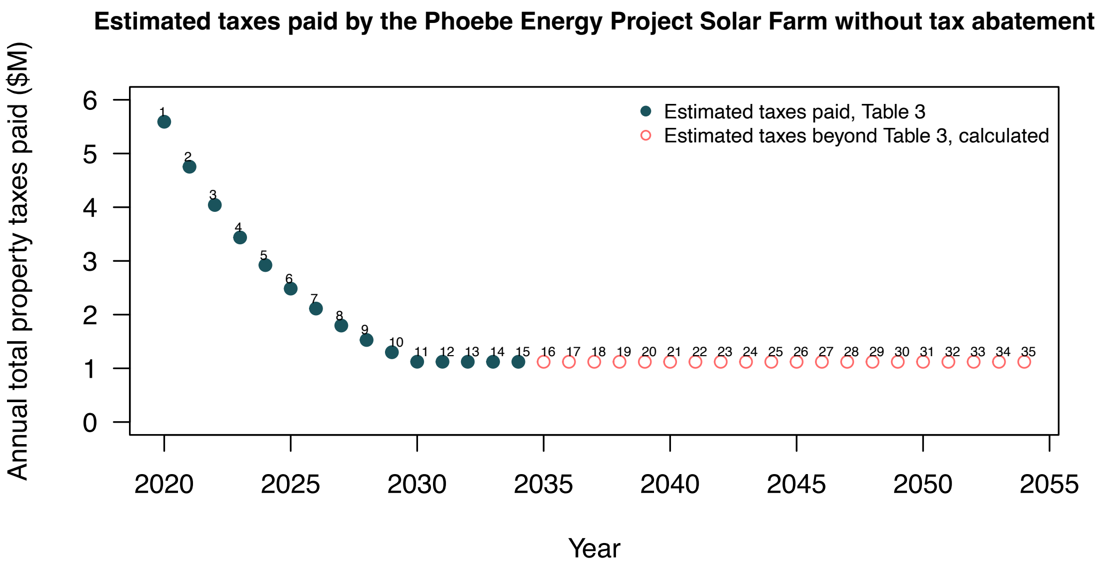

Figure 10: Ad valorem taxes paid as taken from Table 3 of the Phoebe Energy Project Solar Farm's Chapter 313 certificate package (solid dots #1-15) and our estimated future taxes paid (hollow dots #16-35).

Table 2 gives a summary of our estimated and levelized (per 100 MW) unabated taxes paid over the lifetime of solar and wind projects to Texas counties.

Table 2: Estimated levelized (per 100MW) taxes (millions) paid over the lifetime of solar and wind projects to Texas counties without tax abatements.

Project Life	Years	25	30	35
Solar Taxes	Lifetime $M/100MW	$15.21	$17.01	$18.81
Wind Taxes	Lifetime $M/100MW	$23.95	$25.04	$26.12

Energy storage taxes

Taxes paid for energy storage projects were calculated differently than for wind and solar projects. Energy storage projects differ in that they never qualified for the Chapter 313 abatements and thus their projected tax schedules are not public. Thus, we asked multiple companies that have and are planning on developing energy storage projects in Texas to provide us with the data needed to develop similar estimates.

Multiple companies responded and we were able to review data for about 30 projects located across the state of various sizes. Using these data, we estimate that energy storage projects will pay about $4.5M (per 100 MW) of installed capacity over their lifetime, with an estimated range of $3.8M—$4.7M (per 100 MW) in lifetime taxes.

Generally, energy storage projects have a shorter lifetime, about half as much, than what is expected for wind and solar projects and while technology upgrades are likely possible in the future, we did not consider their impact on taxes here. Thus, we estimate that tax values for energy storage projects are generally comparable to those of renewable energy projects when the differences in project lifetimes are considered.

Landowner payments methodology

Landowner payment contracts are not public documents and the landowners are often not allowed to discuss their terms. Thus, we relied on information from renewable project developers and law firms that often represent landowners to make these calculations. This report includes two sets of landowner payments calculations:

1. Landowner payment values used in earlier versions of this report; and
2. Updated landowner payment calculations based on updated data that reflect more recent payment terms.

Wind landowner payments

Wind landowner payments are the more complicated of the two as they include many aspects of the wind farm in their calculation. The calculations relied heavily on information provided by Mr. Rod Wetsel, Attorney at Wetsel, Carmichael, and Allen, LLP., in Sweetwater, Texas.

Mr. Wetsel provided a breakdown of how landowners are compensated for the turbines that are on their property including their compensation for the development/scoping stage, one-time payments, and reoccurring payments over the lifetime of the system. This analysis sought to normalize these values per MW of wind installed, so values for the length of roads, number of turbines, size laydown yards, etc. in each stage of development were taken from a National Renewable Energy Lab analysis of the land use requirements for 172 proposed or existing wind farms. Lease payments over the lifetime of the farm were estimated to be based on capacity rather than on project revenues as conversations indicated that that is the direction that most modern contracts take, and the individual terms of any revenue sharing agreement are not public.

These requirements and the compensation levels of each were used to calculate a range of levelized (per MW) landowner payments that might be expected when a wind farm is built. A version of the spreadsheet used for these calculations can be found online.

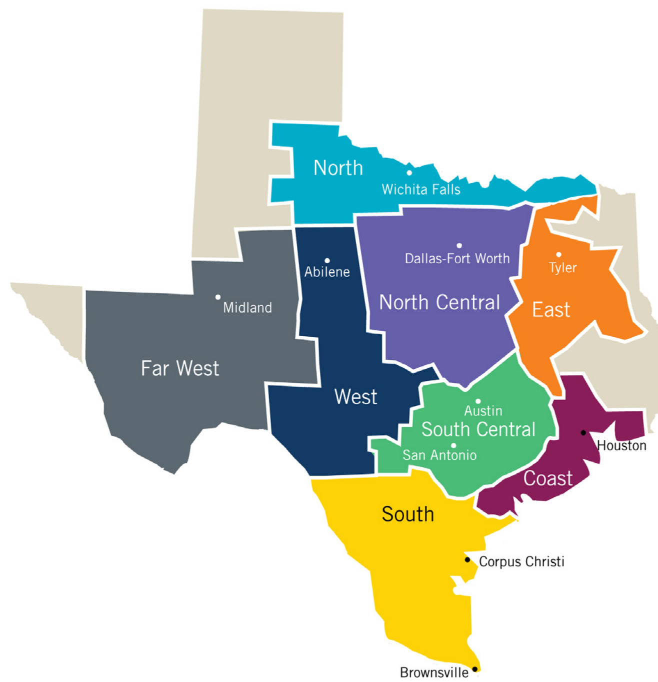

Figure 11: ERCOT weather zone map.

As noted in the information provided by Mr. Wetsel, there is a difference in the level of landowner payment compensation for a particular project depending on its location in the state. Typically, landowners located in South and Coastal Texas are compensated at higher levels than those in West Texas because these projects are physically located closer to load centers, their production profiles are more aligned with peak demand (and thus peak pricing), and the land itself typically has a higher opportunity cost.

Absent the availability of actual data, we assigned a range of landowner payment estimates for individual wind farms based on ERCOT's weather zone map[39] as shown in Figure 11. If a farm was located in the "South", "Coastal", or

39 http://www.ercot.com/news/mediakit/maps

"South Central" regions of ERCOT, we estimated that the landowner payments for that farm would fall in the higher range and all other farms would fall in the lower range.

Table 3 shows our earlier estimates for wind landowner payments and Table 4 shows our updated estimates.

Table 3: Table showing our earlier estimated range of total lifetime landowner payments in millions of dollars per 100 MW wind plant in the various regions of Texas.

Lease Length	(years)	25	30	35
West, Far West, North, North Central, East, and Panhandle[40] Regions of Texas				
Lease Value	($M)	$ 16.2	$ 20.0	$ 24.0
South, South Central, and Coastal Regions of Texas				
Lease Value	($M)	$ 22.8	$ 27.8	$ 33.0

Table 4: Table showing our updated estimated range of total lifetime landowner payments in millions of dollars per 100 MW wind plant in the various regions of Texas.

Lease Length	(Years)	25	30	35
West, Far West, North, North Central, East, and Panhandle[41] Regions of Texas				
Lease Value	($M)	$ 16.4	$ 20.1	$ 24.1
South, South Central, and Coastal regions of Texas				
Lease Value	($M)	$ 23.0	$ 28.0	$ 33.3

Solar landowner payments

Landowner payments for solar projects are simpler to calculate as they are often a simple $/acre-year value. Because solar projects restrict dual use of the land surface more than wind projects, landowner payments are highly dependent on the opportunity cost of the land itself, i.e. productive arable land will command a premium over marginal scrub land. Landowner payments also vary based on location and tend to be higher closer to ERCOT load centers.

Earlier estimates of solar acreage lease values ranged from $200/acre-year to about $700/acre-year, with a 1.75% annual escalator for future years. Our updated estimates found that these lease values have risen to a range of $600/acre-year to $1,000/acre-year with a 2.5% annual escalator. Table 5 shows our earlier range of estimates for the total amount of landowner payments made for a 100 MW solar PV farm in different regions of Texas for various project/lease length estimates and Table 6 shows our updated estimates.

Table 5: Table showing our earlier estimated range of total lifetime landowner payments in millions of dollars per 100 MW solar PV plant in the various regions of Texas.

Lease Length	(Years)	25	30	35
West, Far West, North, and Panhandle[42] Regions of Texas				
Lease Value	Low ($M)	$ 5.2	$ 6.5	$ 7.9
	High ($M)	$ 10.3	$13.0	$ 15.8
South, South Central, East, and North Central Regions of Texas				
Lease Value	Low ($M)	$ 9.0	$11.3	$ 13.9
	High ($M)	$ 15.5	$19.4	$ 23.8
Coastal Region of Texas				
Lease Value	Low ($M)	$ 10.3	$13.0	$ 15.8
	High ($M)	$ 18.0	$22.7	$ 27.7

40 Not shown in Figure 8.

41 Not shown in Figure 8.

42 Not shown in Figure 8.

Table 6: Table showing our* updated *estimated range of total lifetime landowner payments in millions of dollars per 100 MW solar PV plant in the various regions of Texas.

Lease Length	(years)	25	30	35
West, Far West, North, and Panhandle[43] Regions of Texas				
Lease value	Low ($M)	$ 17.0	$ 21.9	$ 27.4
	High ($M)	$ 22.7	$ 29.2	$ 36.5
South, South Central, East, and North Central Regions of Texas				
Lease value	Low ($M)	$19.8	$25.5	$31.9
	High ($M)	$25.5	$32.8	$41.0
Coastal Region of Texas				
Lease value	Low ($M)	$22.7	$29.2	$36.5
	High ($M)	$28.4	$36.4	$45.6

Our research found that solar lease values increased significantly more than wind lease values. This finding is consistent with the much faster growth of solar projects relative to wind projects over the past few years since the development of the earlier estimates.

Energy storage landowner payments

Landowner payments for energy storage projects can vary depending on the structure of the deal. Given the smaller footprint of energy storage projects relative to wind and solar, some developers prefer to purchase the land and thus provide the former owner will the full value upfront, while others enter into a multi-year or multi-decade lease.

Earlier versions of this analysis had very little data from which to estimate the value of landowner payments for energy storage projects. However, as of the writing of this version of the report, almost 10,000 MW of energy storage has been deployed on the grid. This large increase in the projects has provided more data from which to estimate energy storage lease terms.

This analysis found that there are two types of energy storage, energy storage systems that are co-located with generation and stand-alone energy storage projects. Standard term sheets from Mr. Wetsel showed that co-located projects would command about $5,000-$15,000/acre-year while stand-alone projects would bring in between $8,000-$30,000/acre-year. Utilizing a conversion factor of about 13.7 MW/acre yielded the following estimates for landowner payments for energy storage projects, shown in Table 7.

Table 7: Table showing our estimated range of total lifetime landowner payments in millions of dollars per 100 MW of energy storage, by type, in Texas.

Lease length	(years)	25	30	35
Co-located storage projects				
Lease value	Low ($M)	$1.2	$1.6	$2.0
	High ($M)	$3.7	$4.8	$6.0
Stand-alone storage projects				
Lease value	Low ($M)	$2.0	$2.6	$3.2
	High ($M)	$7.5	$9.6	$12.0

43 Not shown in Figure 8.

About the Author

Joshua D. Rhodes, Ph.D. is a research scientist and lecturer at The University of Texas at Austin, a non-resident fellow at Columbia University, a founding partner and CTO of IdeaSmiths LLC, and a commissioner on the City of Austin Electricity Utility Commission. He has authored over 125 scientific articles, columns, op-eds, journal publications, and reports which have been cited over 2,500 times and he has given over 85 keynotes, panel presentations, and other talks. His current area of work is in how energy systems power our modern lives, with a particular focus on new supplies and demands of electricity. He holds a double bachelors in Mathematics and Economics from Stephen F. Austin State University, a masters in Computational Mathematics from Texas A&M University, a masters in Architectural Engineering from The University of Texas at Austin and a Ph.D. in Civil Engineering from The University of Texas at Austin. He enjoys mountain biking, backpacking, and a good cup of coffee.