Vista Sands Solar Project
Docket No: 9820-CE-100

APPENDIX Z

Economic Impact Analysis

Strategic Economic Research, LLC

ECONOMIC IMPACT & LAND USE ANALYSIS OF THE VISTA SANDS SOLAR PROJECT

December 2023

Dr. David G. Loomis,
Bryan Loomis, and
Chris Thankan

Strategic Economic Research, LLC
strategiceconomic.com
815-905-2750

About the Authors

Dr. David G. Loomis, PhD

Professor Emeritus of Economics, Illinois State University
Co-Founder of the Center for Renewable Energy
President of Strategic Economic Research, LLC

Dr. David G. Loomis is Professor Emeritus of Economics at Illinois State University and Co-Founder of the Center for Renewable Energy. He has over 20 years of experience in the renewable energy field. He has served as a consultant for 43 renewable energy development companies.   He has testified on the economic impacts of energy projects before the Illinois Commerce Commission, Iowa Utilities Board, Missouri Public Service Commission, Illinois Senate Energy and Environment Committee, the Wisconsin Public Service Commission, Kentucky Public Service Commission, Ohio Public Siting Board, and numerous county boards. Dr. Loomis is a widely recognized expert and has been quoted in the Wall Street Journal, Forbes Magazine, Associated Press, and Chicago Tribune as well as appearing on CNN.

Dr. Loomis has published over 40 peer-reviewed articles in leading energy policy and economics journals. He has raised and managed over $7 million in grants and contracts from government, corporate and foundation sources. He received the 2011 Department of Energy's Midwestern Regional Wind Advocacy Award and the 2006 Best Wind Working Group Award. Dr. Loomis received his Ph.D. in economics from Temple University in 1995.

Bryan Loomis, MBA

Vice President of Strategic Economic Research, LLC

Bryan Loomis has three years of experience in economic impact, property tax, and land use analysis at Strategic Economic Research. He has performed over 50 wind and solar analyses in the last three years. He improved the property tax analysis methodology by researching various state taxing laws and implementing depreciation, taxing jurisdiction millage rates, and other factors into the tax analysis tool. Before working for SER, Bryan mentored and worked with over 30 startups to help them grow their businesses as CEO and Founder of his own marketing agency. Bryan received his MBA in Marketing from Belmont University in 2016.

Chris Thankan

Economic Analyst

Christopher Thankan assists with the production of the economic impact studies, including sourcing, analyzing, and graphing government data, and performing economic and property tax analysis for wind, solar and transmission projects. Thankan has a Bachelor of Science degree in Sustainable & Renewable Energy and minored in economics.

Strategic Economic Research, LLC (SER) provides economic consulting for renewable energy projects across the U.S. We have produced over 250 economic impact reports in 31 states. Research Associates who performed work on this project include Ethan Loomis, Madison Schneider, Zoe Calio, Patrick Chen, Kathryn Keithley, Morgan Stong, Mandi Mitchell, Coryell Birchfield, Tim Roberts, Riley Bansch and Paige Afram.

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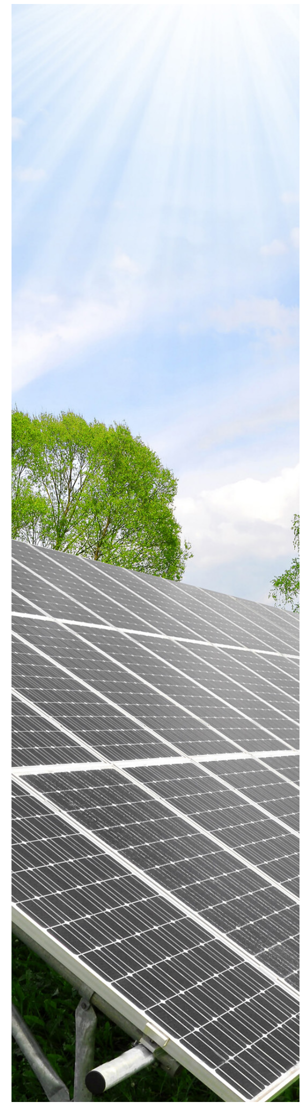

Strategic Economic Research, LLC

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I. Executive Summary

Doral Renewables LLC ("Doral") is developing the Vista Sands Solar Project ("Project") in Portage County, Wisconsin. The purpose of this report is to aid decision makers in evaluating the economic impact of this project on Portage County and the State of Wisconsin. The basis of this analysis is to study the direct, indirect, and induced impacts on job creation, wages, and total economic output.

The Project is an approximately 1,310.4-megawatt alternating current (MWac) utility-scale solar powered-electric generation facility that will utilize photovoltaic (PV) panels installed on a single-axis tracking system. The Project will also include a 300 MW battery energy storage system (BESS). The Project represents an investment in excess of $2.4 billion. The total development is anticipated to result in the following:

Economic Impact

Jobs – all numbers are full-time equivalents

- 506 new local jobs during construction for Portage County
- 2,262 new local jobs during construction for the State of Wisconsin
- 80.0 new local long-term jobs for Portage County
- 164.9 new local long-term jobs for the State of Wisconsin

Output

- Over $78.8 million in new local output during construction for Portage County
- Over $387 million in new local output during construction for the State of Wisconsin
- Over $23.3 million in new local long-term output for Portage County annually
- Over $57.5 million in new local long-term output for the State of Wisconsin annually

Earnings

- Over $49.5 million in new local earnings during construction for Portage County
- Over $217 million in new local earnings during construction for the State of Wisconsin
- Over $5.0 million in new local long-term earnings for Portage County annually
- Over $11.8 million in new local long-term earnings for the State of Wisconsin annually

Tax Revenue

- Approximately $2.8 million in total municipality tax revenue annually
- Approximately $3.7 million in total county tax revenue for Portage County annually

This report also performs an economic land use analysis regarding the leasing of agricultural land for the new solar farm. That analysis yields the following results:

Land Use

Using a real-options analysis, the land use value of solar leasing far exceeds the value of agricultural use.

Portage County:

- For corn farming to generate more income for the landowner and local community than the solar lease, corn prices would need to rise to $21.58 per bushel by the year 2056 or corn yields would need to rise to 345.5 bushels per acre by the year 2027.
- Alternatively, hay prices would need to rise to $937.32 per ton by the year 2056 or hay yields would need to rise to 10.1 tons per acre by the year 2027 for hay farming to generate more income for the landowner and local community than the solar lease.
- At the time of this report, corn and hay prices are $6.13 per bushel and $142 per ton respectively and yields are 174.3 bushels and 2.7 tons per acre respectively.

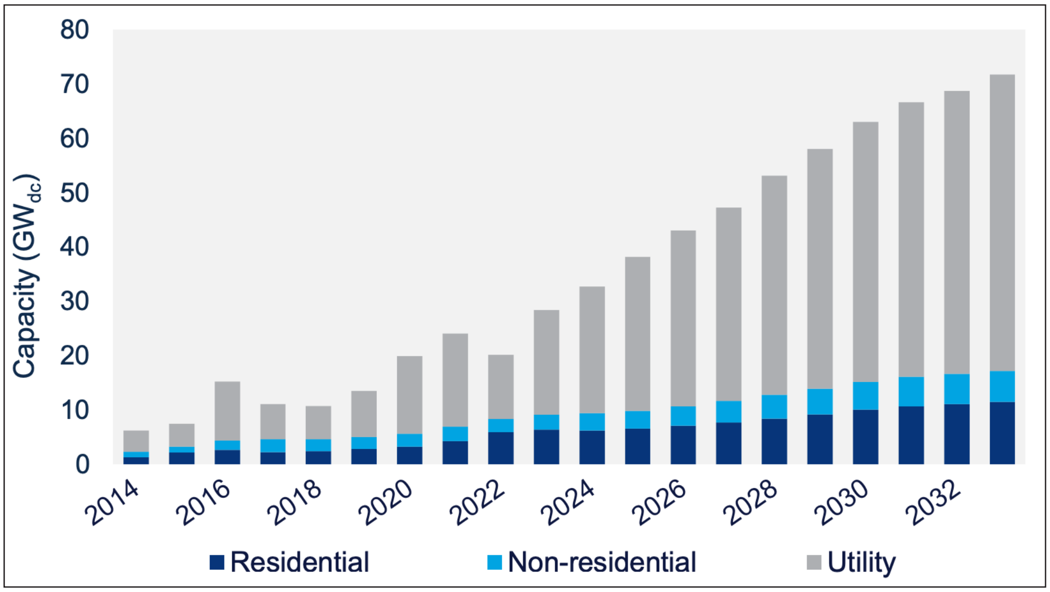
II. U.S. Solar PV Industry Growth and Economic Development

a. U.S. Solar PV Industry Growth

The U.S. solar industry is growing at a rapid but uneven pace. Solar energy systems are installed for onsite use, including residential, commercial and industrial properties, and utility-scale solar powered-electric generation facilities intended for wholesale distribution. The Project is a utility-scale solar PV project intended for wholesale distribution through the transmission grid. From 2013 to 2018, the amount of electricity generated from solar more than quadrupled, increasing 444% (SEIA, 2020). The industry has continued to add increasing numbers of PV systems to the grid. In the first half of 2021, the U.S. installed over 11,000 MW direct current (MWdc) of solar PV driven mostly by utility-scale PV, which exceeds most of the annual installations in the last decade. Figure 1 shows the historical capacity additions as well as the forecasted additions into 2033. The primary driver of this significant growth is large price declines in solar equipment. The overall price of solar PV has declined from $5.79/watt in 2010 to $1.33/watt in 2020 (SEIA, 2020). According to Figure 2, utility-scale solar fixed tilt and single-axis tracking have increased slightly from $0.85/watt and $0.98/watt during the fourth quarter of 2021 to $0.91/watt and $1.01/watt by the fourth quarter of 2022. Solar PV also benefits from the Federal Investment Tax Credit (ITC) and other federal incentives which provide a tax credit and other funding for certain solar projects.

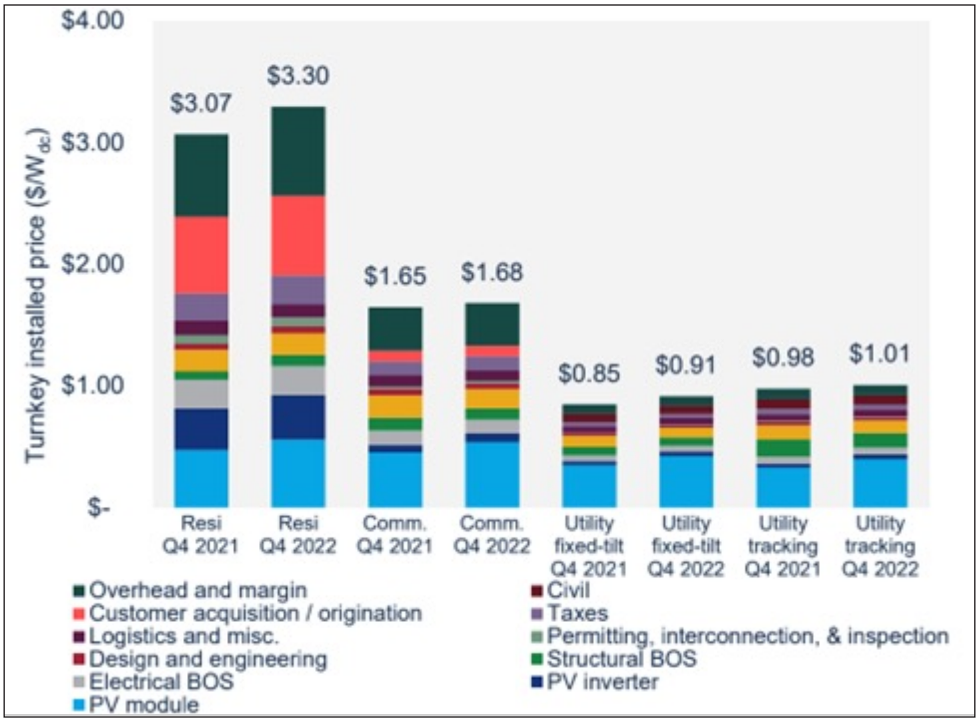
Utility-scale PV leads the installation growth in the U.S. Just under 12 GWdc of utility PV projects were completed in 2022. According to Figure 3, there are 90,300 MWdc of contracted utility-scale installations that have not been built yet.

Figure 1 – Annual U.S. Solar PV Installations, 2014 – 2033E



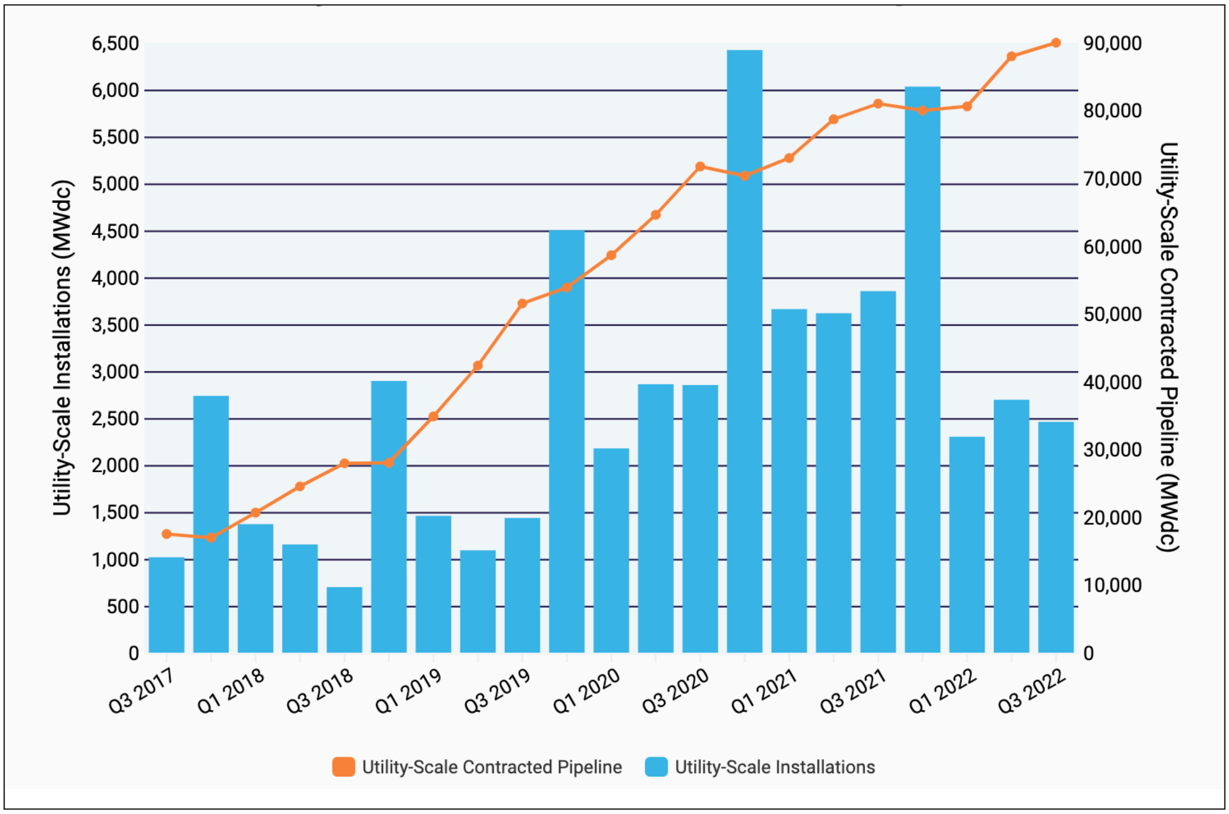
Source: Solar Energy Industries Association, Solar Market Insight Report 2022 Year in Review

Figure 2 – Modeled U.S. National Average System Prices by Market Segment, Q4 2021 and Q4 2022



Source: Solar Energy Industries Association, Solar Market Insight Report 2022 Year in Review

Figure 3 – U.S. Utility PV Installations vs. Contracted Pipeline



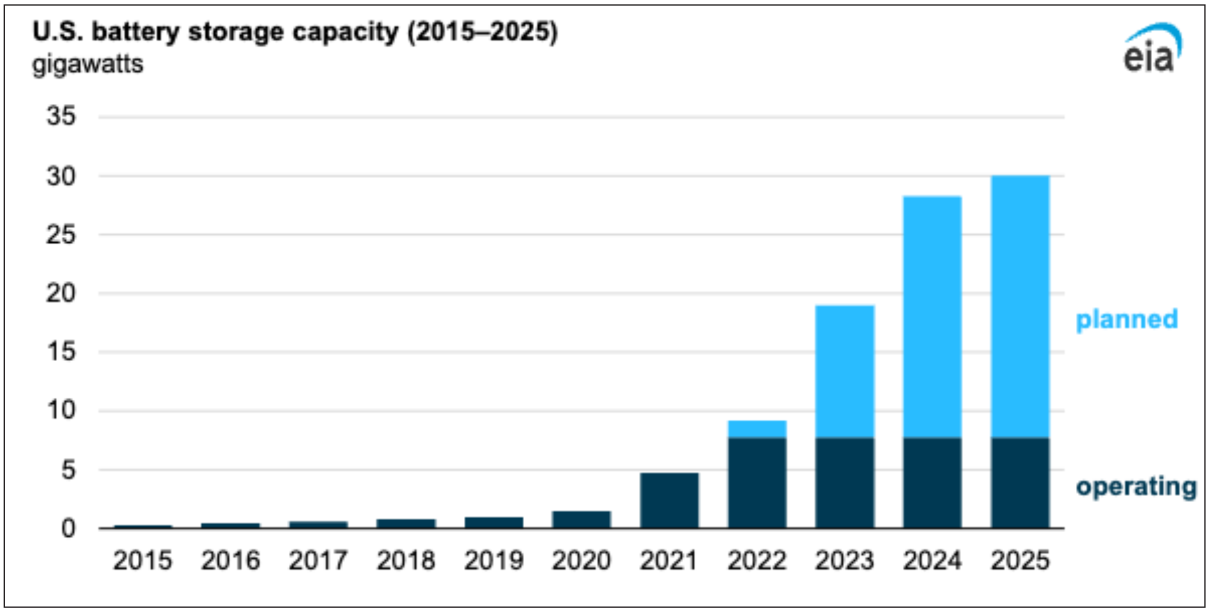
Source: Solar Energy Industries Association, Solar Market Insight Report Q4 2022

b. U.S. Energy Storage Industry Growth

The U.S. energy storage industry is composed primarily of large-scale battery energy storage systems (BESS) and is a recent addition to the electrical grid system. As shown in Figure 4, the large-scale battery capacity has grown rapidly since 2015 but is expected to see accelerated growth over the next few years. The U.S. Energy Information Administration (U.S. EIA) expects the installation of 10,000 megawatts of BESS in the next few years – 10 times the capacity installed in 2019 (U.S. EIA, 2021). The primary driver of this significant growth is large price declines in BESS equipment. Battery systems are used for price arbitrage, i.e., to store electricity when prices are low and discharge electricity when prices are high. Batteries also maintain grid reliability through frequency regulation, ramp generation, spinning reserves, absorbing excess generation and, in some cases, black start capabilities.

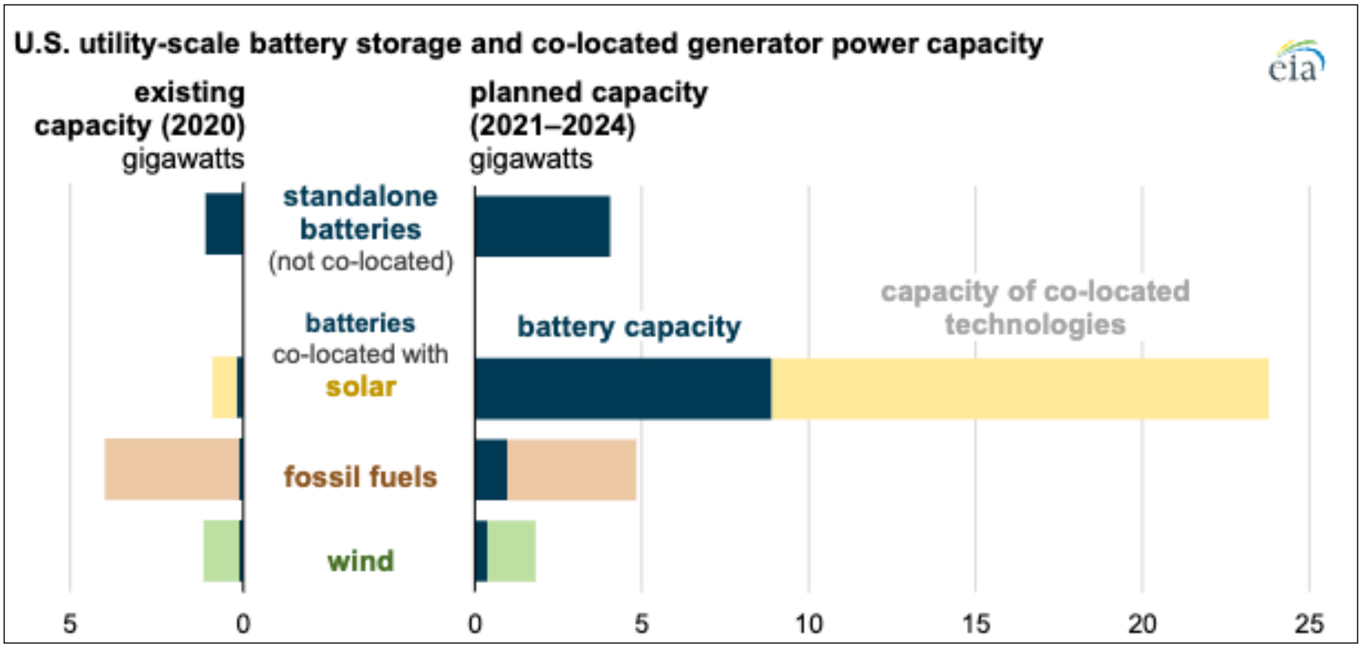
Some battery storage systems are paired with solar energy generators, wind energy generators, or fossil fuel generators. Standalone battery storage systems are increasingly common according to Figure 5.

Figure 4 – Large-Scale Battery Storage Cumulative Power Capacity, 2015-2025E



Source: U.S. Energy Information Administration, U.S. Battery Storage Capacity, 2022

Figure 5 – U.S. Large-Scale Battery Storage Power Capacity Additions, Standalone and Co-located



Source: U.S. Energy Information Administration, Battery Storage Additions, 2021

According to SEIA, Wisconsin is ranked 23rd in the U.S. in cumulative installations of solar PV. California, Texas, and Florida are the top 3 states for solar PV which may not be surprising because of the high solar irradiation that they receive. However, other states with similar solar irradiation to Wisconsin also rank highly including New Jersey (8th), Virginia (9th), New York (10th), and Massachusetts (11th). In 2022, Wisconsin installed 368 MW of solar electric capacity bringing its cumulative capacity to 1,217 MW.

Wisconsin has great potential to expand its solar installations. Wisconsin has several utility-scale solar farms in operation: Badger Hollow Solar (150 MW) in Iowa County; Two Creeks Solar (150 MW) in Manitowoc County; Wood County Solar (150 MW) in Wood County; Point Beach Solar (100 MW) in Manitowoc County; Bear Creek Solar (50 MW) in Richland County; North Rock Solar (50 MW) in Rock County; and O'Brien Solar Fields (20 MW) in Dane County[1]. The 1,310.4 MW Vista Sands Solar Project will be one of the largest installations in Wisconsin to date.

There are 185 solar companies in Wisconsin including 44 manufacturers, 83 installers/developers, and 58 others.[2] Figure 6 shows the locations of solar companies in Wisconsin as of the time of this report. Currently, there are 2,942 solar jobs in the State of Wisconsin according to SEIA.

Figure 7 shows the Wisconsin historical installed capacity by year according to the SEIA. Huge growth was seen in 2021 and is forecasted to continue to grow in 2023 and beyond. Over the next five years, solar in Wisconsin is projected to grow by 4,630 MW.

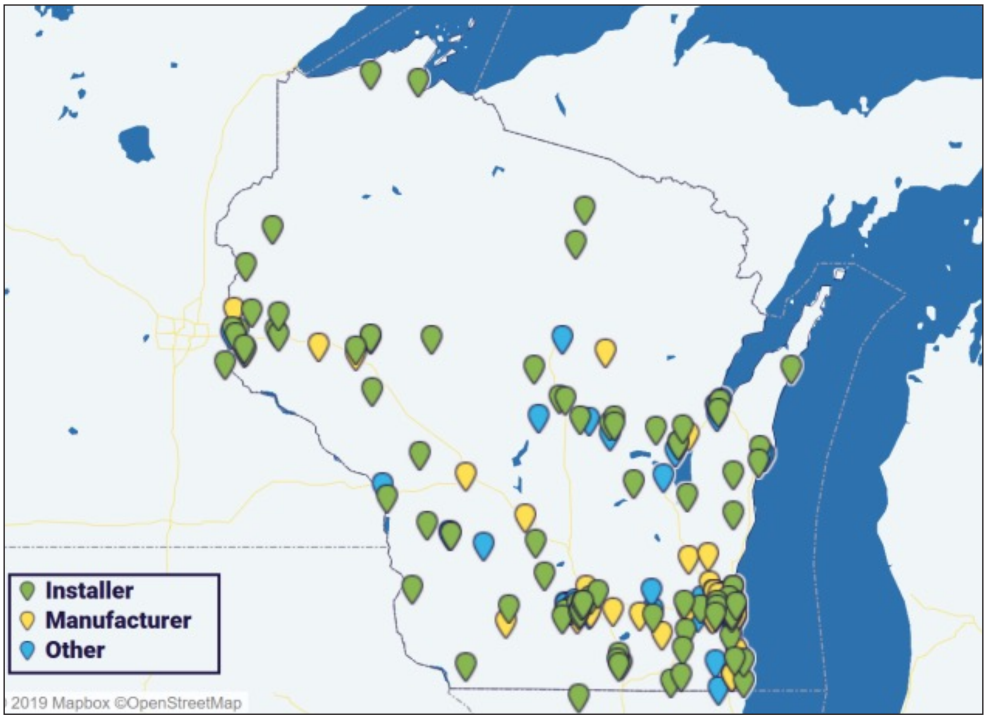
The Energy Information Administration (EIA) calculated the number of megawatt-hours generated from different energy sources in 2022. As shown in Figure 8, the greatest percentage of electricity generated in Wisconsin comes from natural gas with 37.0% followed by coal with 35.8% and nuclear energy with 16.5%. Approximately 1.4% of the total electricity energy generated in Wisconsin came from solar thermal and solar PV in 2022.

The U.S. Department of Energy sponsors the U.S. Energy and Employment Report each year. Electric Power Generation covers all utility and non-utility employment across electric generating technologies, including fossil fuels, nuclear, and renewable technologies. It also includes employees engaged in facility construction, turbine and other generation equipment manufacturing, operations and maintenance, and wholesale parts distribution for all electric generation technologies. According to Figure 9, employment in Wisconsin in the solar energy industry (4,174) is larger than wind electric generation (1,885), coal electricity (1,775), and natural gas generation (1,204).

[1] The megawatts listed in this paragraph are MWac. To convert to MWdc, multiply the MWac by 1.3 to get the approximate MWdc capacity.

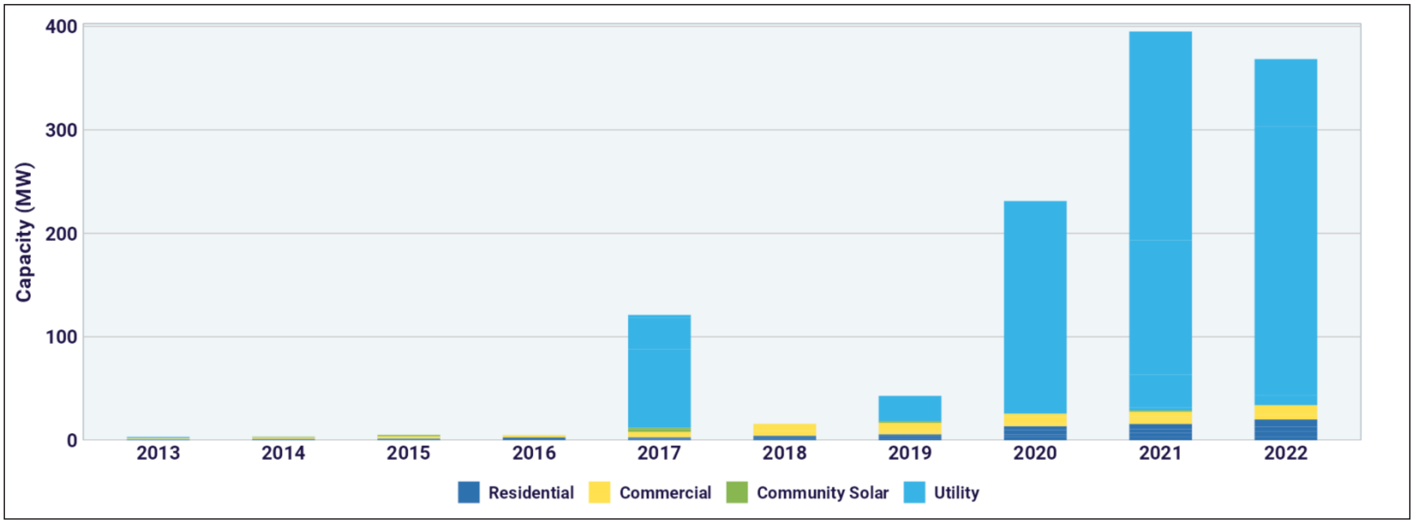
[2] "Other" includes Sales and Distribution, Project Management, and Engineering.

Figure 6 – Solar Company Locations in Wisconsin



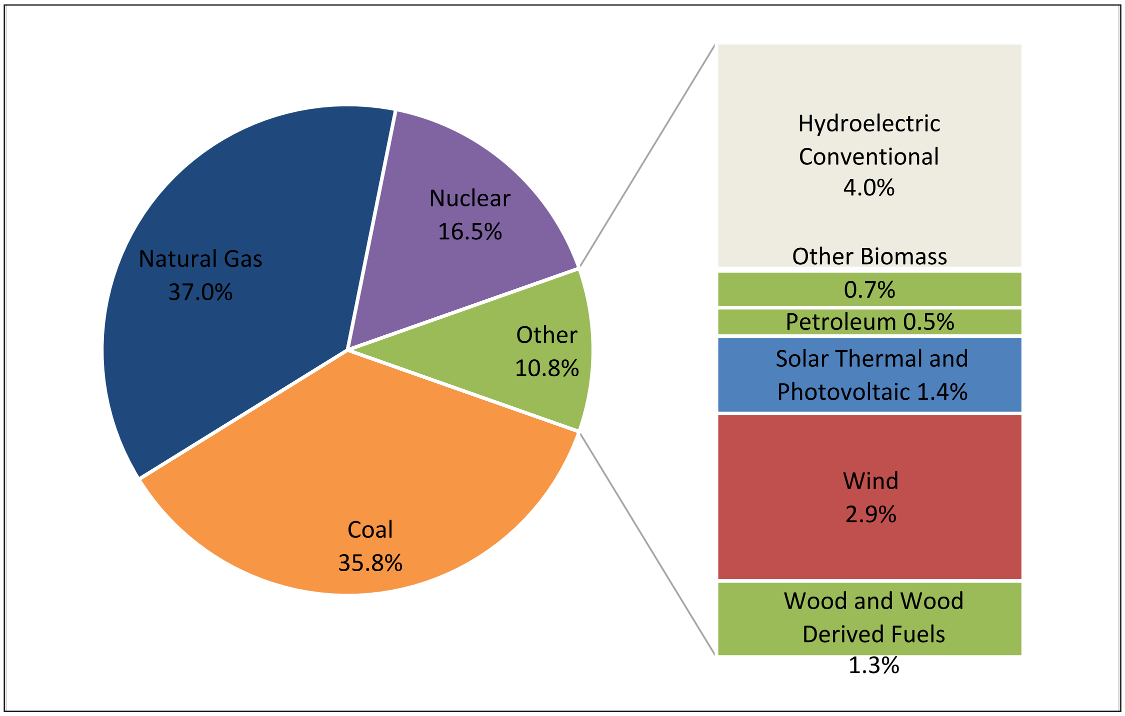
Source: Solar Energy Industries Association, Solar Spotlight: Wisconsin, Q1 2023

Figure 7 – Wisconsin Annual Solar Installations



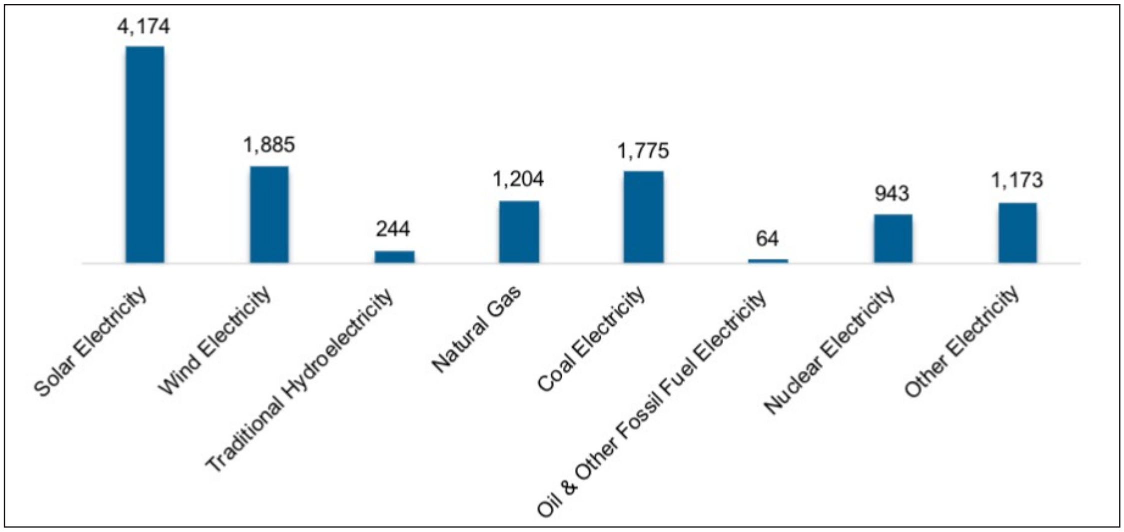
Source: Solar Energy Industries Association, Solar Spotlight: Wisconsin, Q1 2023

Figure 8 – Electric Generation by Fuel Type for Wisconsin in 2022



Source: U.S. Energy Information Association (EIA): Wisconsin, 2022

Figure 9 – Electric Generation Employment by Technology



Source: U.S. Energy and Employment Report 2023: Wisconsin

d. Economic Benefits of Utility-Scale Solar PV Energy

Utility-scale solar powered-electric generation facilities have numerous economic benefits. Solar PV installations create job opportunities in the local area during both the short-term construction phase and the long-term operational phase. In addition to the workers directly involved in the construction and maintenance of the solar energy project, numerous other jobs are supported through indirect supply chain purchases and the higher spending that is induced by these workers. Solar PV projects strengthen the local tax base and help improve county services, and local infrastructure, such as public roads.

Numerous studies have quantified the economic benefits of solar PV projects across the United States and have been published in peer-reviewed academic journals using the same methodology as this report. Some of these studies examine smaller-scale solar systems and some examine utility-scale solar energy. Croucher (2012) uses NREL's Jobs and Economic Development Impacts ("JEDI") modeling methodology to find which state will receive the greatest economic impact from installing one hundred 2.5 kW residential systems. He shows that Pennsylvania ranked first supporting 28.98 jobs during installation and 0.20 jobs during operations. Illinois ranked second supporting 27.65 jobs during construction and 0.18 jobs during operations.

More recently, Michaud et al. (2020) performed an analysis of the economic impact of utility-scale solar energy projects in the State of Ohio. They detail three scenarios: low (2.5 GW), moderate (5 GW) and high (7.5 GW). Using the JEDI model, they find that between 18,039 and 54,113 jobs would be supported during construction and between 207 and 618 jobs would be supported annually during operations. In addition, between $22.5 million and $67.5 million annually in tax revenues would come from these projects.

Knapp (2021) examines the local economic impact from installing a 150 MW solar project in rural Wisconsin with a 100% local workforce. He finds that such a project would generate $11.8 million in economic activity.

Several other reports quantify the economic impact of solar energy. Bezdek (2006) estimates the economic impact for the State of Ohio and finds the potential for PV market in Ohio to be $25 million with 200 direct jobs and 460 total jobs. The Center for Competitive Florida (2009) estimates the impact if the state were to install 1,500 MW of solar and finds that 45,000 direct jobs and 50,000 indirect jobs could be created. The Solar Foundation (2013) uses the JEDI modeling methodology to show that Colorado's solar PV installation to date created 10,790 job-years. They also analyze what would happen if the state were to install 2,750 MW of solar PV from 2013 to 2030 and find that it would result in nearly 32,500 job years. Berkman et al. (2011) estimates the economic and fiscal impacts of the 550 MWac Desert Sunlight Solar Farm. The project creates approximately 440 construction jobs over a 26-month period, $15 million in new sales tax revenues, $12 million in new property revenues for Riverside County, CA, and $336 million in indirect benefits to local businesses in the county.

Finally, Jenniches (2018) performed a review of the literature assessing the regional economic impacts of renewable energy sources. After reviewing all of the different techniques for analyzing the economic impacts, he concludes "for assessment of current renewable energy developments, beyond employment in larger regions, IO [Input-Output] tables are the most suitable approach" (Jenniches, 2018, 48). Input-Output analysis is the basis for the methodology used in the economic impact analysis of this report.

e. Economic Benefits of Energy Storage

Battery storage facilities have numerous economic benefits. BESS installations create job opportunities in the local area during both the construction phase and the operational phase. In addition to the workers directly involved in the construction and maintenance of the project, numerous other jobs are supported through indirect supply chain purchases and the higher spending that is induced by these workers. Battery storage projects strengthen the local tax base and help improve county services and local infrastructure, such as public roads.

Several studies have quantified the economic benefits of battery storage projects across the United States. Gorman et al. (2020) demonstrate the economic value that battery storage brings to the electric grid. Using wholesale market prices, they find that the additional revenues from adding batteries to solar are higher than the additional costs. They do not quantify the economic impact that battery storage will make.

Truitt et al. (2022) is an NREL study that makes state-level employment projections for battery storage (along with wind, solar and energy storage). For the total U.S., they find that 66,751 were employed in the battery storage sector in 2020 and that 126,000-181,000 jobs will be in the sector by 2025 and 197,000-376,000 jobs will be in the sector by 2030 (Truitt, 2022, vi). The study used the IMPLAN model multipliers which are the same multipliers used in this present study.

The Energy Storage Association (2020) predicted that energy storage would create at least 200,000 jobs by 2030. They cite a "2017 Navigant analysis that assumed that industry jobs per new MW of storage capacity installed would decline from 50 per MW in 2021 to 34 per MW by 2025. The attainment of 100 GW by 2030 would involve rapidly growing annual installations between 2025 and 2030, but a continued decline in jobs/MW as the industry continues to refine construction techniques and management" (ESA, 2020, p. 8-9). We avoid such projections by analyzing the company's costs of construction and operation rather than using broad industry assumptions.

III. Project Description and Location

a. Vista Sands Solar Project

Doral is developing the Project in Portage County, Wisconsin. The Project consists of an estimated 1,310.4 MWac utility-scale solar powered-electric generation facility that will use PV panels installed on a single-axis tracking system. This Project will also include a 300 MW battery energy storage system. The total Project represents an investment in excess of $2.4 billion.

b. Portage County, Wisconsin

Portage County is located in the central part of Wisconsin (see Figure 10). It has a total area of 823 square miles, and the U.S. Census estimates that the 2022 population was 70,718 with 31,702 housing units. The county has a population density of 87.9 (persons per square mile) compared to 108.8 for the State of Wisconsin (2020). Median household income in the county was $65,550 (U.S. Census Bureau, 2021).

Figure 10 – Location of Portage County, Wisconsin

As shown in Table 1, the largest industries in the county are "Administrative Government" followed by "Finance and Insurance," "Manufacturing" and "Retail Trade." These data for Table 1 come from IMPLAN covering the year 2021 (the latest year available).

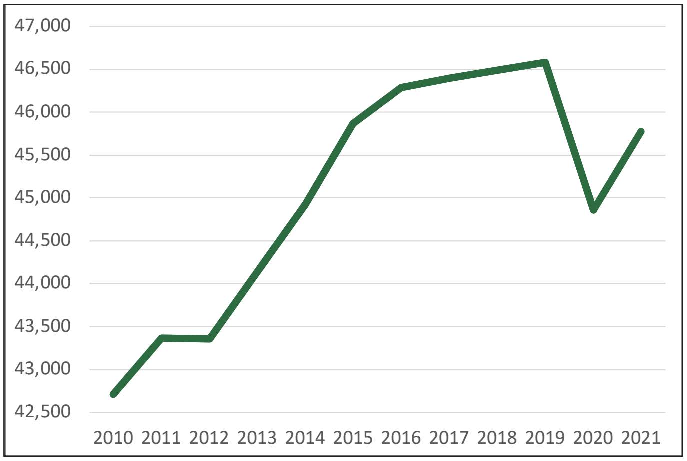
Table 1 provides the most recent snapshot of total employment but does not examine the historical trends within the county. Figure 11 shows employment from 2010 to 2021. Total employment in Portage County was at its lowest at 42,714 in 2010 and its highest at 46,579 in 2019 (BEA, 2023).

Table 1 – Employment by Industry in Portage County

Industry	Number	Percent
Administrative Government	5,275	12.1%
Finance and Insurance	5,112	11.7%
Manufacturing	4,827	11.0%
Retail Trade	4,493	10.3%
Health Care and Social Assistance	3,689	8.4%
Accommodation and Food Services	3,354	7.7%
Transportation and Warehousing	2,736	6.3%
Agriculture, Forestry, Fishing and Hunting	2,321	5.3%
Professional, Scientific, and Technical Services	2,264	5.2%
Other Services (except Public Administration)	2,238	5.1%
Construction	1,932	4.4%
Administrative and Support and Waste Management and Remediation Services	1,461	3.3%
Real Estate and Rental and Leasing	1,393	3.2%
Wholesale Trade	1,216	2.8%
Arts, Entertainment, and Recreation	418	1.0%
Government Enterprises	339	0.8%
Information	279	0.6%
Management of Companies and Enterprises	152	0.3%
Educational Services	98	0.2%
Utilities	83	0.2%
Mining, Quarrying, and Oil and Gas Extraction	29	0.1%

Source: Impact Analysis for Planning (IMPLAN), County Employment by Industry, 2021

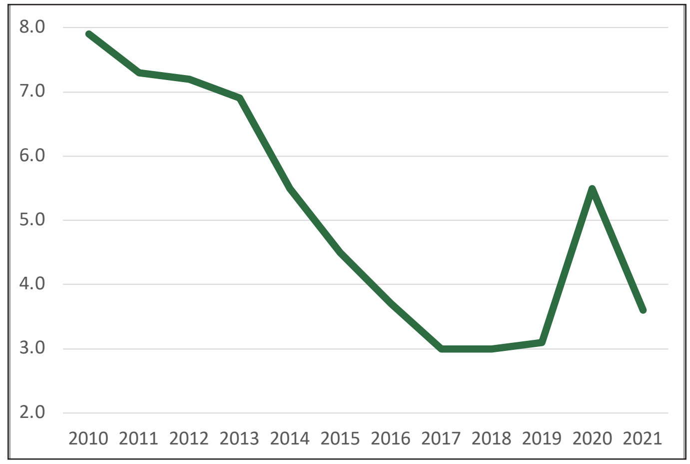
Figure 11 – Total Employment in Portage County from 2010 to 2021



Source: Bureau of Economic Analysis, Regional Data, GDP and Personal Income, 2010-2021

The unemployment rate signifies the percentage of the labor force without employment in the county. Figure 12 shows the unemployment rates from 2010 to 2021. Unemployment in Portage County was at its highest at 7.9% in 2010 and its lowest at 3.0% in 2017 (FRED, 2023).

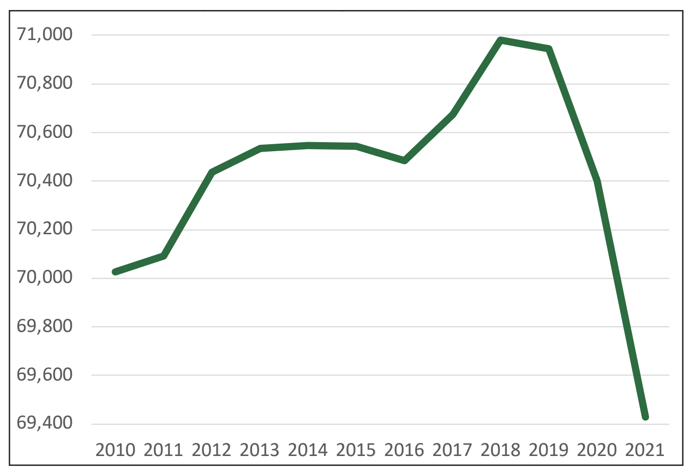
Figure 12 – Unemployment Rate in Portage County from 2010 to 2021



Source: Federal Reserve Bank of St. Louis Economic Data, U.S. Census Bureau, Unemployment Rates, 2010-2021

The overall population in the county has fluctuated greatly, as shown in Figure 13. Portage County's population climbed to a high of 70,979 in 2018 but hit a low of 69,429 in 2021, a loss of 1,550 people. The average annual population decrease from 2018 through 2021 was 517 people.

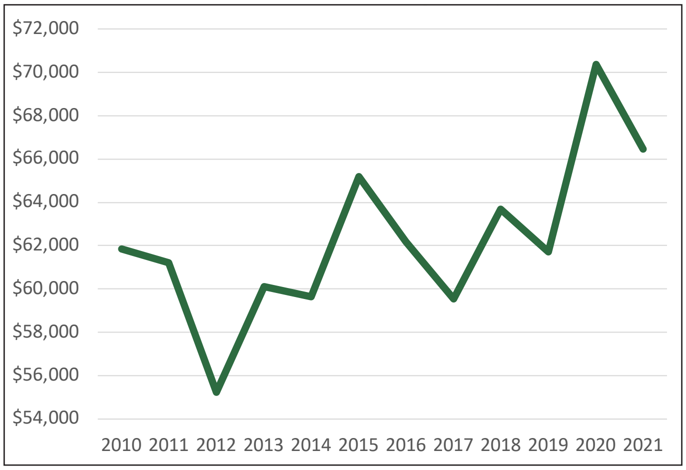
Figure 13 – Population in Portage County from 2010 to 2021



Source: Federal Reserve Bank of St. Louis Economic Data, U.S. Census Bureau, Population Estimates, 2010-2021

The household income has trended upwards in the county. Figure 14 shows the real median household income in Portage County from 2010 to 2021. Using the national Consumer Price Index (CPI), the nominal median household income for each year was adjusted to 2021 dollars. Household income was at its lowest at $55,239 in 2012 and its highest at $70,367 in 2020 (FRED, 2023).

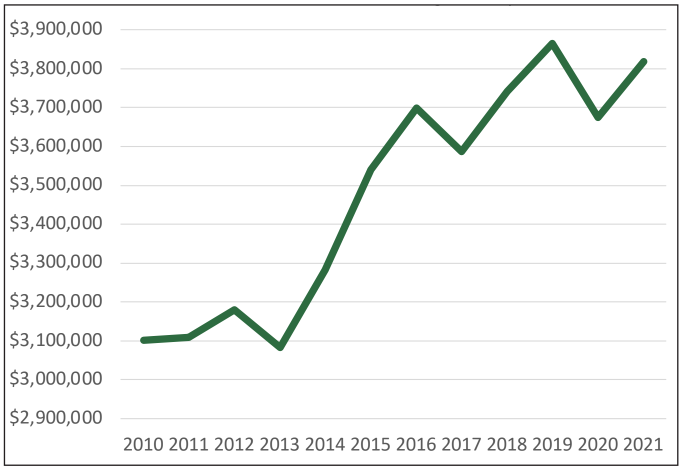
Figure 14 – Real Median Household Income in Portage County from 2010 to 2021



Source: Federal Reserve Bank of St. Louis Economic Data, U.S. Census Bureau, Estimate of Median Household Income, 2010-2021

Real Gross Domestic Product (GDP) is a measure of the value of goods and services produced in an area and adjusted for inflation over time. The Real GDP for Portage County has fluctuated upwards since 2010, as shown in Figure 15 (BEA, 2023).

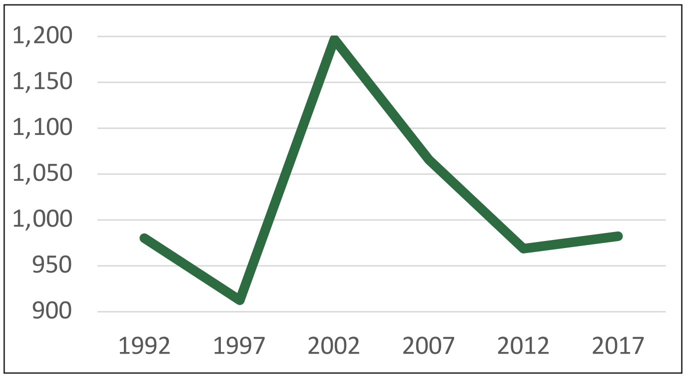
Figure 15 – Real Gross Domestic Product (GDP) in Portage County from 2010 to 2021



Source: Bureau of Economic Analysis, Regional Data, GDP and Personal Income, 2010-2021

The farming industry has fluctuated in Portage County. As shown in Figure 16, the number of farms hit a low of 913 in 1997 and a high of 1,197 in 2002. Since 2002, the number of farms in the county has decreased significantly.

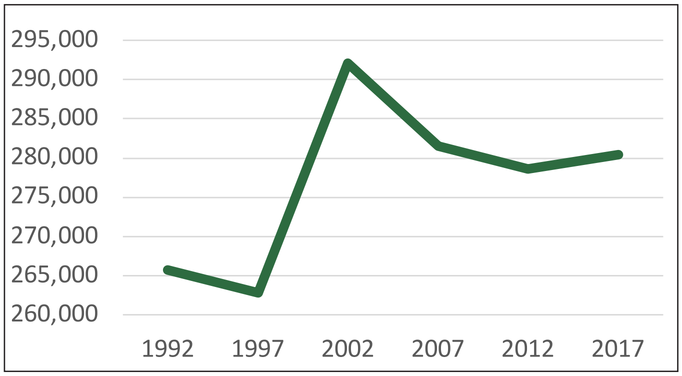
Figure 16 – Number of Farms in Portage County from 1992 to 2017



Source: USDA National Agricultural Statistics Service, Census of Agriculture, 1992-2017

The amount of land in farms has fluctuated greatly as well. The county farmland hit a low of 262,799 acres in 1997 and a high of 292,109 acres in 2002, according to Figure 17. Since 2002, the amount of land in farms has declined in the county.

Figure 17 – Land in Farms in Portage County from 1992 to 2017



Source: USDA National Agricultural Statistics Service, Census of Agriculture, 1992-2017

ii. Agricultural Statistics

Wisconsin is ranked ninth among U.S. states in total value of agricultural products sold (Census, 2017). It is ranked eighth in the value of livestock and sixteenth in the value of crops (Census, 2017). In 2022, Wisconsin had 64,100 farms and 14.2 million acres in operation with the average farm being 222 acres (State Agricultural Overview, 2022). Wisconsin had 1.27 million cattle and produced 31.8 billion pounds of milk (State Agricultural Overview, 2022). In 2022, Wisconsin yields averaged 180 bushels per acre for grain corn with a total market value of $3.4 billion (State Agricultural Overview, 2022). Soybeans yields averaged 54 bushels per acre with a total market value of $1.61 billion (State Agricultural Overview, 2022). The average net cash farm income per farm is $36,842 (Census, 2017).

In 2017, Portage County had 982 farms covering 280,410 acres for an average farm size of 286 acres (Census, 2017). The total market value of products sold was $280 million, with 27% coming from livestock sales and 73% coming from crop sales (Census, 2017). The average net cash farm income of operations was $58,468 (Census, 2017).

The 6,500 acres planned to be used by the Project represents just 2.3% of the acres used for farming in Portage County. As we will show in the next section, solar farming is a better land use on a purely economic basis than livestock or crops for the particular land in this Project.

IV. Land Use Methodology

To analyze the specific economic land use decision for a solar energy facility, this section uses a methodology first proposed by Gazheli and Di Corato (2013). A "real options" model is used to look at the critical factors affecting the decision to lease agricultural land to a company installing a solar powered electric generating facility. According to their model, the landowner will look at their expected returns from the land that include the following: the price that they can get for the crop (typically corn or soybeans); the average yields from the land that will depend on amount and timing of rainfall, temperature and farming practices; and the cost of inputs including seed, fuel, herbicide, pesticide and fertilizer. Not considered is the fact that the landowner faces annual uncertainty on all these items and must be compensated for the risk involved in each of these parameters changing in the future. In a competitive world with perfect information, the returns to the land for its productivity should relate to the cash rent for the land.

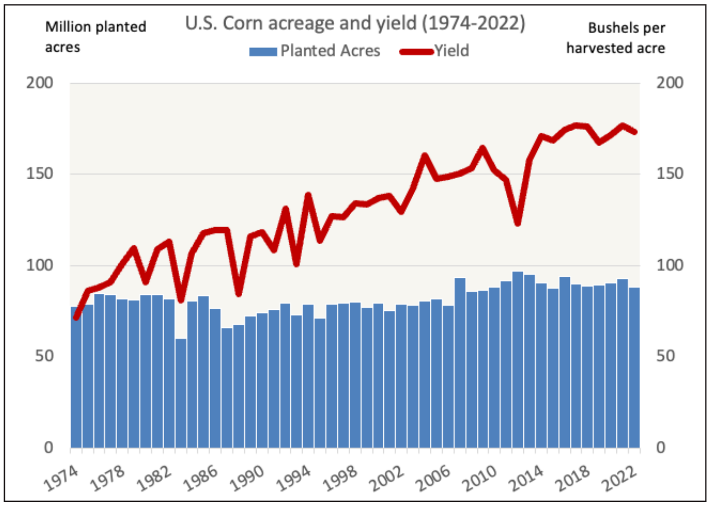
For the landowner, the key analysis will be comparing the net present value of the annual solar lease payments to expected profits from farming. The farmer will choose the solar farm lease if:

$$NPV\ (Solar\ Lease\ Payment_t) > NPV\ (P_t * Yield_t - Cost_t)$$

Where NPV is the net present value; Solar Lease $Payment_t$ is the lease payment the owner receives in year t; P_t is the price that the farmer receives for the crop (corn or soybeans) in year t; $Yield_t$ is the yield based on the number of acres and historical average of county-specific productivity in year t; $Cost_t$ is the total cost of farming in year t and will include the cost of seed, fertilizer, the opportunity cost of the farmer's time. Farming profit is the difference between revenue (price times yield) and cost. The model will use historical agricultural data from the county (or state when the county data is not available).

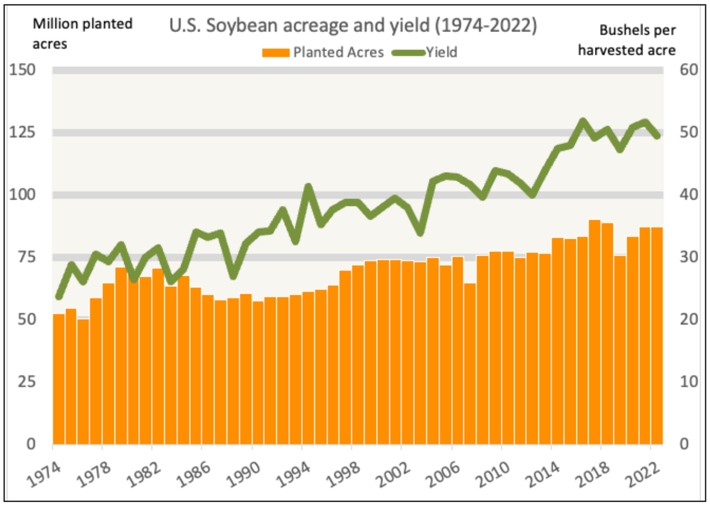
Figure 18 shows the dramatic increase in U.S. corn yields since 1974. Soybean yields have also increased though not as dramatically. Figure 19 displays the soybean yields in the U.S. since 1974.

Figure 18 – U.S. Corn Acreage and Yield



Source: USDA National Agricultural Statistics Service, Quick Stats, 2023

Figure 19 – U.S. Soybean Acreage and Yield



Source: USDA National Agricultural Statistics Service, Quick Stats, 2023

The standard net present value calculation presented above, uses the expected value of many of the variables that are stochastic (have some randomness to them). In order to forecast returns from agriculture in future years, we use a linear regression using an intercept and time trend on historical data to predict future profits.

$$\pi_t = \propto + \beta * time$$

Where π_t is the farming profit in year t; α is intercept; β is the trend and time is a simple time trend starting at 1 and increasing by 1 each time period.

V. Land Use Results

In order to analyze future returns from farming the land, we will use historical data from Portage County to examine the local context for this analysis. The United States Department of Agriculture's National Agricultural Statistics Service publishes county-level statistics every five years. Table 2 shows the Portage County historical data from 1992 to 2017 for total farm income, production expenses, average farm size, net cash income, and average market value of machinery per farm.

Table 2 – Agricultural Statistics for Portage County, Wisconsin

	1992	1997	2002	2007	2012	2017
Total Farm Income Per Farm	NA	$3,926	$6,736	$11,445	$14,094	$12,730
Total Farm Production Expenses (average/farm)	$80,740	$93,694	$93,477	$149,569	$232,916	$234,603
Average Farm Size (acres)	271	288	244	264	288	286
Net Cash Income per Farm[3]	$12,342	$30,669	$27,649	$40,503	$80,971	$58,468
Average Market Value of Machinery Per Farm	$97,055	$100,544	$97,225	$128,456	$203,828	$221,156

Source: USDA National Agricultural Statistics Service, Census of Agriculture, 1992-2017

The production expenses listed in Table 2 include all direct expenses like seed, fertilizer, fuel, etc. but do not include the depreciation of equipment and the opportunity cost of the farmer's own time in farming. To estimate these last two items, we can use the average market value of machinery per farm and use straight-line depreciation for 30 years with no salvage value. This is a very conservative estimate of the depreciation since the machinery will likely qualify for a shorter life and accelerated or bonus depreciation. To calculate the opportunity cost of the farmers time, we obtained the mean hourly wage for farming in each of these years from the Bureau of Labor Statistics. Again, to be conservative, we estimate that the farmer spends a total of 16 weeks @ 40 hours/week farming in a year. It seems quite likely that a farmer spends many more hours than this including direct and administrative time on the farm. These statistics and calculations are shown in Table 3.

[3] Net Cash Income per farm is reported by the NASS and does not exactly equal income minus expenses. NASS definition for this item is, "Net cash farm income of the operators. This value is the operators' total revenue (fees for producing under a production contract, total sales not under a production contract, government payments, and farm-related income) minus total expenses paid by the operators. Net cash farm income of the operator includes the payments received for producing under a production contract and does not include value of commodities produced under production contract by the contract growers. Depreciation is not used in the calculation of net cash farm income."

Table 3 – Machinery Depreciation and Opportunity Cost of Farmer's Time for Portage County, Wisconsin

	1992	1997	2002	2007	2012	2017
Average Market Value Machinery Per Farm	$97,055	$100,544	$97,225	$128,456	$203,828	$221,156
Annual Machinery Depreciation over 30 years - Straight Line (Market Value divided by 30)	$3,235	$3,351	$3,241	$4,282	$6,794	$7,372
Mean Hourly Wage in WI for Farming (Bureau of Labor Statistics)	$6.14	$6.98	$8.79	$9.65	$10.81	$12.55
Annual Opportunity Cost of Farmer's Time (Wage times 16 weeks times 40 Hours/Week)	$3,930	$4,467	$5,626	$6,176	$6,918	$8,032

To get the total profitability of the land, we take the net cash income per farm and subtract depreciation expenses and the opportunity cost of the farmer's time. To get the profit per acre, we divide by the average farm size. Finally, to account for inflation, we use the Consumer Price Index (CPI) to convert all profit into 2017 dollars (i.e. current dollars).[4] These calculations and results are shown in Table 4.

Table 4 – Profit Per Farm Calculations for Portage County, Wisconsin

	1992	1997	2002	2007	2012	2017
Net Cash Income per Farm	$12,342	$30,669	$27,649	$40,503	$80,971	$58,468
Machinery Depreciation	($3,235)	($3,351)	($3,241)	($4,282)	($6,794)	($7,372)
Opportunity Cost of Farmer's Time	($3,930)	($4,467)	($5,626)	($6,176)	($6,918)	($8,032)
Profit	$5,177	$22,850	$18,783	$30,045	$67,258	$43,064
Average Farm Size (Acres)	271	288	244	264	288	286
Profit Per Acre	$19.10	$79.34	$76.98	$113.81	$233.54	$150.57
CPI	141.9	161.3	180.9	210.036	229.601	246.524
Profit Per Acre in 2017 Dollars	$33.19	$121.26	$104.90	$133.58	$250.75	$150.57

[4] We will use the Consumer Price Index for All Urban Consumers (CPI-U) which is the most common CPI used in calculations. For simplicity, we will just use the CPI abbreviation.

Using an unsophisticated static analysis, the farmer would be better off using his land for solar if the solar lease rental per acre exceeds the 2017 profit per acre of $150.57 which adjusts to $185.76 after accounting for inflation in Portage County. Yet this static analysis fails to capture the dynamics of the agricultural market and the farmer's hope for future prices and crop yields to exceed the current level. To account for this dynamic, we use the real options model discussed in the previous section. Recall that the net returns from agriculture fluctuates according to the following equation:

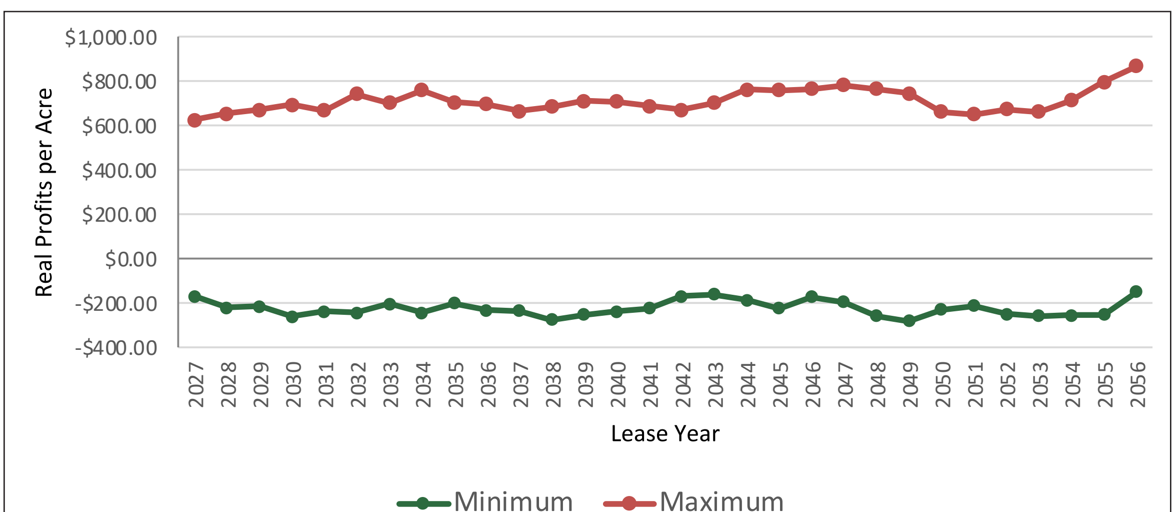
$$\pi_t = \propto + \beta * time$$

Where π_t is the farming profit in year t; α is intercept; β is the trend and time is a simple time trend starting at 1 and increasing by 1 each time period.

Using the Census of Agriculture data from 1992 to the present, the intercept is $54.92 with a standard error of $39.42. The time trend is $5.74 with a standard error of 2.47. This means that agriculture profits are expected to rise by $5.74. Both the intercept and the coefficient on the time trend have a wide variation as measured by the standard error. The wide variation means that there will be a lot of variability in agricultural profits from year to year.

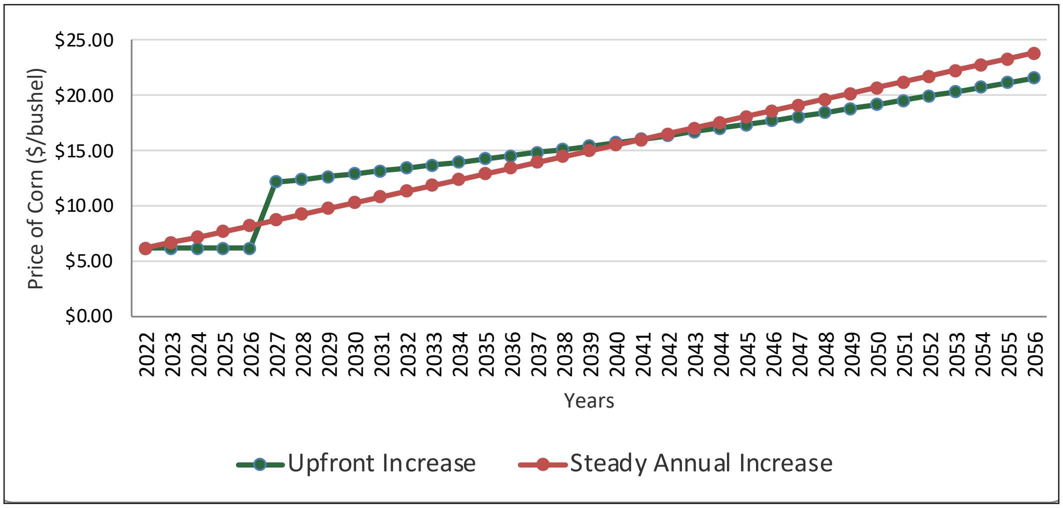
Over the period from 2017 to 2056, we assume that the profit per acre follows the equation above but allows for the random fluctuations. Because of this randomness, we can simulate multiple futures using a Monte Carlo simulation. We assume that the solar farm will begin operation in 2027 and operate through 2056. Using 500 different simulations, the real profit per acre never exceeds $1,101 in any single year. Overall, the maximum average annual profit over the 30 years is $814 and the maximum average annual loss is $144. Figure 20 is a graph of the highest and lowest real profit per acre simulations. When comparing the average annual payment projected in the maximum simulation by 2056 to the solar lease per acre payment, the solar lease provides higher returns than farming in all of the 500 simulations. This means the farmer is financially better off under the solar lease in 100% of the 500 scenarios analyzed.

Figure 20 – Simulations of Real Profits Per Acre Based on Data from 1992



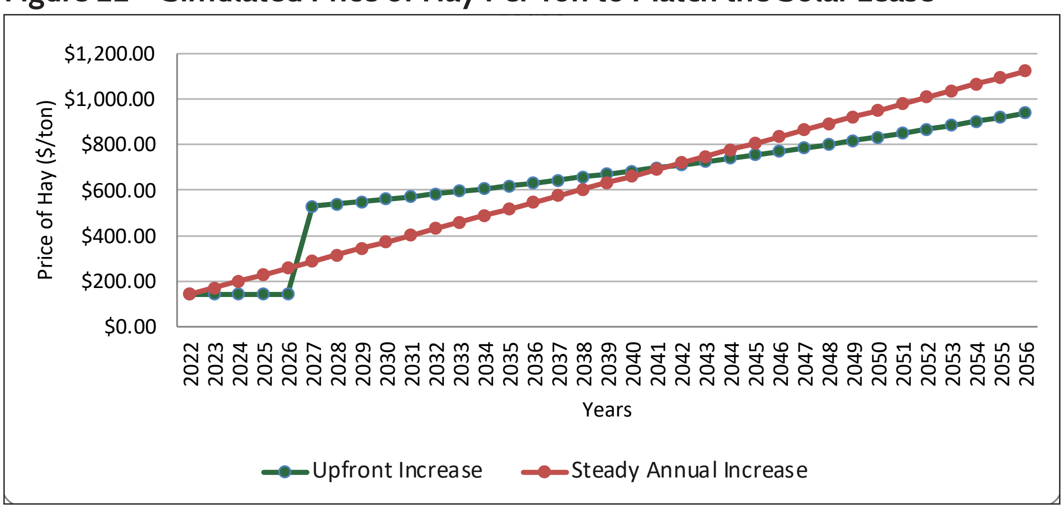
Another way to look at this problem would be to ask: How high would corn prices have to rise to make farming more profitable than the solar lease? Below we assume that the yields on the land and all other input costs stay the same. In this case, corn prices would have to rise from $6.13 per bushel in 2022 to $12.15 in 2027 and rise to $21.58 per bushel by 2056 as shown in Figure 21. Alternatively, corn prices would need to rise by $0.52 per bushel each year from 2022 to 2056 when it would reach $23.79 per bushel.

Figure 21 –Simulated Price of Corn Per Bushel to Match the Solar Lease



Now let's turn our attention to hay prices. If we assume the yields and input costs stay the same, hay prices would have to rise from $142 per ton in 2022 to $527.82 per ton in 2027 and rise to $937.32 by 2056 as shown in Figure 22. For a linear increase, hay prices would need to rise by $28.83 per ton each year from 2022 to 2056 when it would reach $1,122.15 per ton.

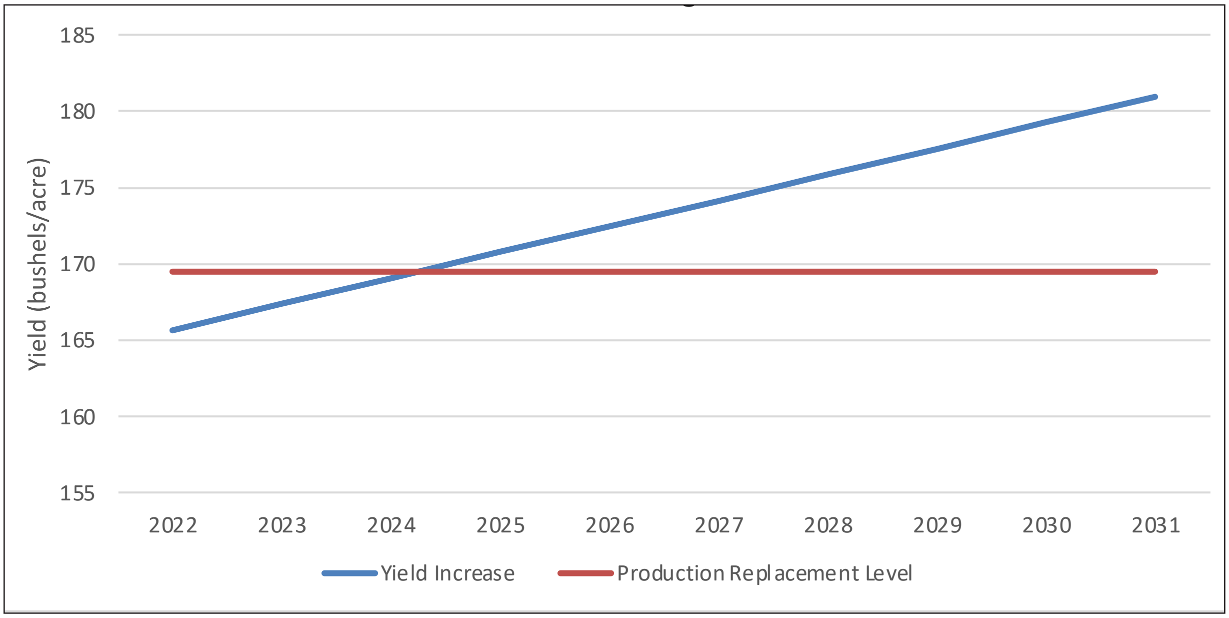
Figure 22 – Simulated Price of Hay Per Ton to Match the Solar Lease



If we assume that the price of corn stays the same, the yields for corn would need to increase from 174.3 bushels per acre in 2022 to 345.5 bushels per acre in 2027 and stay at that level until 2056. The yields for hay would need to rise from 2.7 tons per acre in 2022 to 10.1 tons per acre in 2027 and stay there until 2056.

Statewide, over the past 30 years, corn yields have increased by 1.7 bushels per year. If 6,500 acres are taken out of production of the county's 280,410, the remaining 273,910 acres would be expected to produce 465,153 bushels more annually just by being more productive on-trend. At 146.9 bushels per year (2022 State Agriculture Overview yield), the 6,500 acres would reduce production by 1,132,950 bushels. Thus, the increased yields would take just 2.01 years to make up for the acreage taken out of production from the solar project.

Figure 23 – Expected Annual Increase in Production Due to Higher Yields from Corn Versus Expected Decrease in Production from Acreage



Solar energy projects are compatible with agricultural land use by benefiting the land while solar farms are in operation. Some of these benefits include increased pollination, improved soil quality, and increased future production from soil fallowing.

Recent research has shown that pollinating insects can help soybean yields and improvement in pollinator habitats has been shown to boost soybean production (Garibaldi et. al. 2021; de O. Milfant, 2013). Walston, et al. (2018) shows the potential for agricultural benefits from pollinator habitats in the United States. Using native plant species in the land around solar projects can improve pollinator habitats which leads to increased yields, and the partial shading caused by solar panels can be quite beneficial to pollinators (Graham, et al. 2021). Additionally, BRE (2014) shows that utility-scale solar can increase biodiversity.

Solar energy projects built on agricultural lands will allow the soil to rest for around 30 years. The U.S. Department of Energy (2022) states that "land can be reverted back to agricultural uses at the end of the operational life for solar installations. A life of a solar installation is roughly 20-25 years and can provide a recovery period, increasing the value of that land for agriculture in the future. Giving soil rest can also maintain soil quality and contribute to the biodiversity of agricultural land. Planting crops such as legumes underneath the solar installation can increase nutrient levels in the soil."

Several studies have shown that leaving the soil fallow for an extended period of time increases the productivity of the land when it is returned to crop production. Cusimano et al. (2014) found that the use of land fallowing can induce significant improvements to soil quality and crop production in California. Kozak and Pudelko (2021) studied abandoned land in Poland and showed that fallowed land could be restored to agricultural production.

VI. Economic Impact Methodology

The economic analysis of the Project uses IMPLAN (IMpact analysis for PLANning). IMPLAN software and data are managed and updated by the Minnesota IMPLAN Group, Inc., using data collected at federal, state, and local levels. IMPLAN is a leading provider of economic development software that is widely used by economists and economic development professionals. More information about IMPLAN can be found at http:/implan.com.

IMPLAN is an input-output model that measures the spending patterns and location-specific economic structures that reflect expenditures supporting varying levels of employment, income, and output. That is, IMPLAN takes into account that the output of one industry can be used as an input for another. For example, when a PV system is installed, there are both soft costs consisting of permitting, installation and customer acquisition costs as well as hardware costs, of which the PV module is the largest component. The purchase of a module not only increases demand for manufactured components and raw materials, but also supports labor to build and install a module. When a module is purchased from a manufacturing facility, the manufacturer uses some of that money to pay employees. The employees use a portion of their compensation to purchase goods and services within their community. Likewise, when a developer pays workers to install the systems, those workers spend money in the local economy that boosts economic activity and employment in other sectors. The goal of economic impact analysis is to quantify all of those reverberations throughout the local and state economy.

The IMPLAN model utilizes county-specific and state-specific industry multipliers in the analysis. This study analyzes the gross jobs that the new solar energy project development supports and does not analyze the potential loss of jobs due to declines in other forms of electric generation.

The total economic impact can be broken down into three distinct types: direct impacts, indirect impacts, and induced impacts. **Direct impacts** during the construction period refer to the changes that occur in the onsite construction industries in which the direct final demand (i.e., spending on construction labor and services) change is made. Onsite construction-related services include installation labor, engineering, design, and other professional services. Direct impacts during operating years refer to the final demand changes that occur in the onsite spending for the solar operations and maintenance workers.

The initial spending on the construction and operation of the solar PV installation will create a second layer of impacts, referred to as "supply chain impacts" or "indirect impacts." **Indirect impacts** during the construction period consist of changes in inter-industry purchases resulting from the direct final demand changes and include construction spending on materials and PV equipment, as well as other purchases of goods and offsite services. Utility-scale solar PV indirect impacts include PV modules, invertors, tracking systems, cabling, and foundations.

Induced impacts during construction refer to the changes that occur in household spending as household income increases or decreases as a result of the direct and indirect effects of final demand changes. Local spending by employees working directly or indirectly on the Project that receive their paychecks and then spend money in the community is included. The model includes additional local jobs and economic activity that are supported by the purchases of these goods and services.

The majority of the jobs during construction are construction workers but there are other occupations involved as well. In addition, during operations, there are other occupations involved besides solar technicians. A sample of those occupations, the education/training needed and wages percentiles, is contained in Table 9 in the Appendix. A larger description of those occupations, their work environment, and future job growth is found in Table 10 in the Appendix.

VII. Economic Impact Results

The economic impact results were derived from detailed project cost estimates supplied by Doral. In addition, Doral also estimated the percentages of project materials and labor that will be coming from within Portage County and the State of Wisconsin.

Two sets of models were produced to show the economic impact of the Project. The first set of models examines the construction costs and the second set of models examines the operating expenses. The first model uses the capital expenditures and the 2021 IMPLAN Portage County dataset. The second model uses the 2021 IMPLAN dataset for the State of Wisconsin and the same project costs. The third model uses the operating expenditures and the 2021 IMPLAN Portage County dataset. The fourth model uses the 2021 IMPLAN dataset for the State of Wisconsin and the same project costs. The latest dataset from IMPLAN and specific project cost data from the Vista Sands Solar Project are used and SER translated the project costs into IMPLAN sectors.

Tables 5 to 7 show the output from these models. Table 5 lists the total employment impact from the Vista Sands Solar Project for Portage County and the State of Wisconsin. Table 6 shows the impact on total earnings and Table 7 contains the impact on total output.

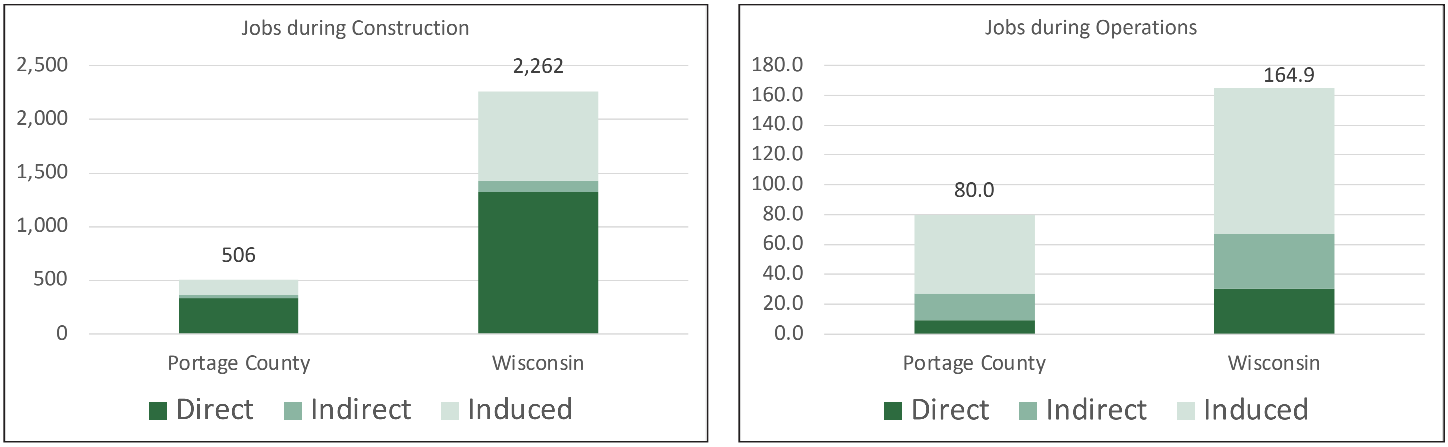
Table 5 – Total Employment Impact from the Vista Sands Solar Project

	Portage County Jobs	State of Wisconsin Jobs
Construction		
Direct Impacts	333	1,321
Indirect Impacts	31	104
Induced Impacts	142	837
Local Jobs during Construction	506	2,262
Operations (Annual/Ongoing)		
Onsite Direct Impacts	9.2	30.2
Indirect Impacts	18.2	36.6
Induced Impacts	52.6	98.1
Local Long-Term Jobs	80.0	164.9

The results from the IMPLAN model show significant employment impacts from the Project. Employment impacts can be broken down into several different components. Direct jobs created during the construction phase typically last anywhere from 12 to 18 months depending on the size of the project; however, the direct job numbers present in Table 5 from the IMPLAN model are based on a full time equivalent (FTE) basis for a year. In other words, 1 job = 1 FTE = 2,080 hours worked in a year. A part time or temporary job would constitute only a fraction of a job according to the model. For example, the IMPLAN model results show 333 new direct jobs during construction in Portage County, though the construction of the solar center could involve closer to 666 workers working half-time for a year. Thus, due to the short-term nature of construction projects, IMPLAN often significantly understates the actual number of people hired to work on the project. It is important to keep this fact in mind when looking at the numbers or when reporting the numbers.

As shown in Table 5, new local jobs created or retained during construction total 506 for Portage County and 2,262 for the State of Wisconsin. New local long-term jobs created from the Project total 80.0 for Portage County and 164.9 for the State of Wisconsin.

Figure 24 – Total Employment Impact from the Vista Sands Solar Project



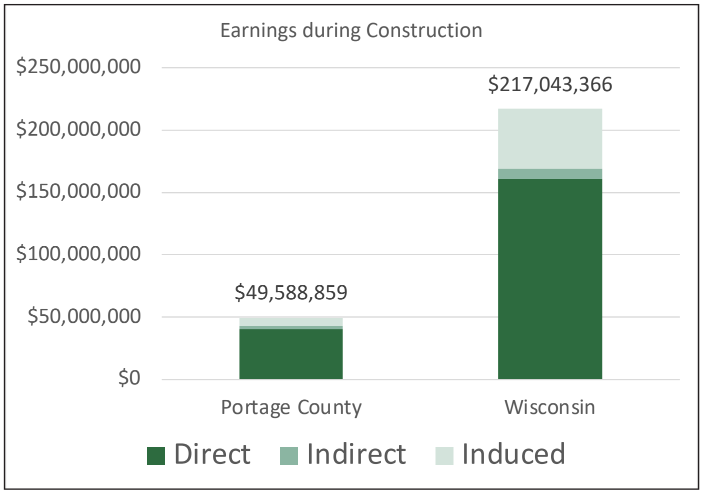
Direct jobs created during the operational phase last the life of the solar PV project, typically 20-30 years. Both direct construction jobs and operations and maintenance jobs require highly-skilled workers in the fields of construction, management, and engineering. For a list of occupations expected to be employed, their wages, benefits, total compensation, and hours worked, please see Tables 11 to 13 in the Appendix.

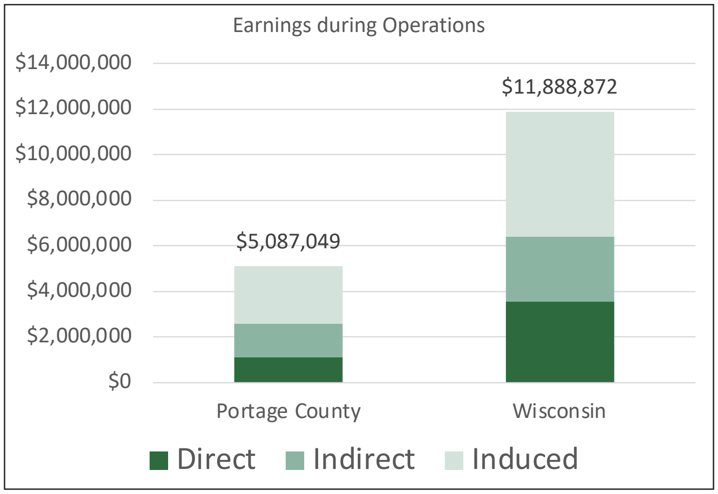
Accordingly, it is important to not just look at the number of jobs but also the earnings that they produce. Table 6 shows the earnings impacts from the Project, which are categorized by construction impacts and operations impacts. The new local earnings during construction totals over $49.5 million for Portage County and over $217 million for the State of Wisconsin. The new local long-term earnings totals over $5.0 million for Portage County and over $11.8 million for the State of Wisconsin.

Table 6 – Total Earnings Impact from the Vista Sands Solar Project

	Portage County	State of Wisconsin
Construction		
Direct Impacts	$40,434,000	$160,536,000
Indirect Impacts	$2,221,223	$8,641,690
Induced Impacts	$6,933,636	$47,865,676
Local Earnings during Construction	$49,588,859	$217,043,366
Operations (Annual/Ongoing)		
Onsite Direct Impacts	$1,089,200	$3,564,000
Indirect Impacts	$1,475,878	$2,820,232
Induced Impacts	$2,521,971	$5,504,640
Local Long-Term Earnings	$5,087,049	$11,888,872

Figure 25 – Total Earnings Impact from the Vista Sands Solar Project



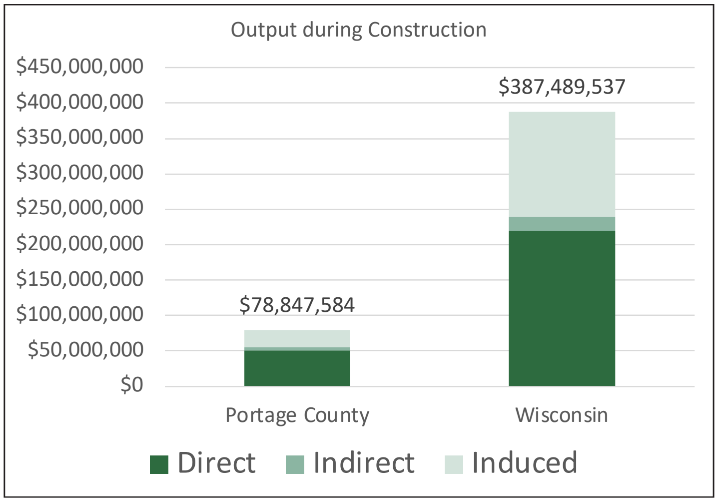


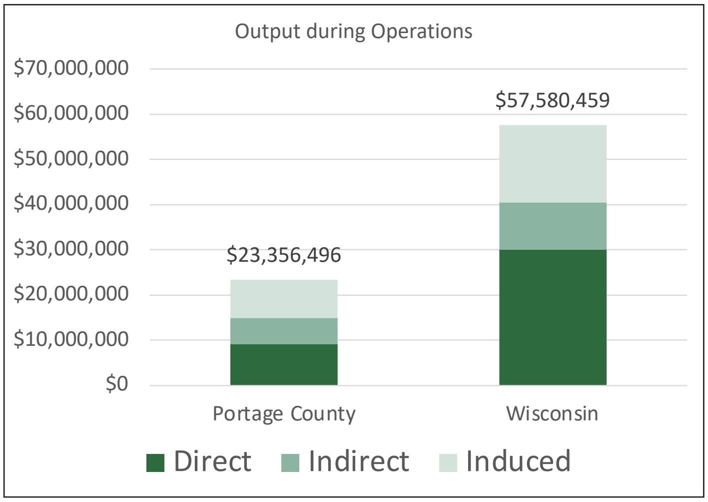
Output refers to economic activity or the value of production in the state or local economy. It is an equivalent measure to the Gross Domestic Product, which measures output on a national basis. As listed in Table 7, the new local output during construction totals over $78.8 million for Portage County and over $387 million for the State of Wisconsin. The new local long-term output totals over $23.3 million for Portage County and over $57.5 million for the State of Wisconsin.

Table 7 – Total Output Impact from the Vista Sands Solar Project

	Portage County	State of Wisconsin
Construction		
Direct Impacts	$50,829,963	$219,468,817
Indirect Impacts	$4,688,732	$20,361,636
Induced Impacts	$23,328,889	$147,659,084
Local Output during Construction	$78,847,584	$387,489,537
Operations (Annual/Ongoing)		
Onsite Direct Impacts	$9,190,050	$30,071,006
Indirect Impacts	$5,707,022	$10,469,236
Induced Impacts	$8,459,424	$17,040,217
Local Long-Term Output	$23,356,496	$57,580,459

Figure 26 – Total Output Impact from the Vista Sands Solar Project





VIII. Tax Revenue

Utility-scale solar PV projects, like other utility-scale energy generating facilities in Wisconsin, are exempt from property taxes. However, the county and municipalities in which the projects are located will receive increased revenue through the State of Wisconsin's shared revenue utility aid fund. This funding creates a new revenue source for county and municipal government services and is intended to reimburse the communities for the lost property tax revenue due to the tax exemption. Additionally, other sources of revenue may be available from the State of Wisconsin.

Table 8 details the shared revenue utility aid tax implications of the Project. There are two important assumptions built into the analysis in this table. First, the analysis assumes that the Project has a capacity of 1,310.4 MW for taxing purposes. Second, the projections use the MW based payment and incentive payment formulas in the "Wisconsin Shared Revenue Utility Aid Summary" developed by the Wisconsin Department of Revenue.

The host municipalities will split approximately $2.84 million annually and Portage County will receive approximately $3.71 million annually.

Table 8 – Illustration of "Utility Aid" Paid

	Total	Municipalities	County
MW based Payment	$2,620,800	$873,600	$1,747,200
Incentive Payment	$3,931,200	$1,965,600	$1,965,600
Total	$6,552,000	$2,839,200	$3,712,800

Although school districts do not receive payments from the Utility Aid Fund, and subject to reaching agreement with the local school districts, Doral plans to offer a Pledge Agreement through which Doral would provide approximately $200 per MW annually to the local school districts where the Project is sited. There are no other local permitting fees associated with the Project.

IX. Appendix

Table 9 – Local and Statewide Compensation by Occupation[5]

BLS Occupation Code	Job Type	Education/Training Required	Wisconsin 10th Percentile of Wages	Wisconsin 90th Percentile of Wages	Wisconsin Mean Wages	Wausau, WI 10th Percentile of Wages	Wausau, WI 90th Percentile of Wages	Wausau, WI Mean Wages	US Fringe Benefits Median	Total Compensation Local mean wages plus US Fringe
	Jobs during Construction									
47-2231	Solar Photovoltaic Installers	High school diploma or equivalent	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	$27,394	#N/A
47-3013	Helpers – Electricians	High school diploma or equivalent	$29,620	$48,750	$38,080	#N/A	#N/A	#N/A	$27,394	#N/A
47-2111	Electricians	High school diploma or equivalent	$39,050	$100,370	$70,180	$42,360	$88,000	$69,940	$27,394	$97,334
47-2061	Construction Laborers	No formal educational credential	$31,100	$70,360	$48,540	$35,120	$60,480	$46,210	$27,394	$73,604
47-2073	Operating Engineers and Other Construction Equipment Operators	High school diploma or equivalent	$47,210	$91,770	$68,810	$48,800	$84,040	$67,450	$27,394	$94,844
47-1011	First-Line Supervisors of Construction Trades	High school diploma or equivalent	$49,140	$102,710	$75,840	$44,750	$98,060	$71,600	$27,394	$98,994
13-1082	Project Management Specialists and Business Operations Specialists		$56,710	$135,250	$95,020	$52,470	$131,990	$92,580	$27,394	$119,974
49-9071	Maintenance and Repair Workers, General (Operations)	High school diploma or equivalent	$29,930	$63,250	$46,530	$31,520	$61,860	$47,420	$27,394	$74,814
13-1111	Management Analysts	Bachelor's degree	$55,120	$149,410	$96,980	$51,960	$127,320	$93,270	$27,394	$120,664
11-1021	General and Operations Managers	Bachelor's degree	$56,900	#N/A	$135,930	$57,260	$238,270	$137,820	$27,394	$165,214
17-2071	Electrican Engineers		$66,690	$130,520	$95,920	$71,080	$127,850	$95,240	$27,394	$122,634
41-3091	Sales Representatives of Services		$34,800	$119,340	$71,730	$32,250	$104,430	$63,440	$27,394	$90,834
53-7062	Laborers and Freight, Stock and Material Movers	No formal educational credential	$28,430	$50,710	$39,940	$29,570	$50,050	$39,170	$27,394	$66,564
43-3031	Bookkeeping, Accounting and Auditing	Some college, no degree	$30,950	$60,060	$45,190	$31,690	$58,860	$44,580	$27,394	$71,974
	Jobs during Operations									
51-8013	Power Plant Operators	High school diploma or equivalent	$47,330	$113,510	$80,170	#N/A	#N/A	#N/A	$27,394	#N/A
37-3011	Landscaping and Groundskeeping	No formal educational credential	$23,000	$47,340	$36,460	$21,750	$47,190	$35,300	$27,394	$62,694
51-1011	First-Line Supervisors of Production and Operating Workers	High school diploma or equivalent	$45,010	$88,020	$66,100	$46,580	$82,610	$64,670	$27,394	$92,064

[5] The Project is not located in Wausaw, WI but is adjacent to it.

Table 10 – Occupational Description and Future Outlook

Occupation Code	Occupation Title	Description	Work Environment	Current Employment	Job Growth, 2021-2031 (percent)
11-1021	General and Operations Managers	Plan, direct, or coordinate the operations of public or private sector organizations, overseeing multiple departments or locations. Duties and responsibilities include formulating policies, managing daily operations, and planning the use of materials and human resources, but are too diverse and general in nature to be classified in any one functional area of management or administration, such as personnel, purchasing, or administrative services. Usually manage through subordinate supervisors. Excludes First-Line Supervisors.	Top executives work in nearly every industry, for both small and large organizations. They often have irregular schedules, which may include working evenings and weekends. Travel is common, particularly for chief executives.	3,328,200	209,800 (7%)
13-1082	Project Management Specialists and Business Operations Specialists	Analyze and coordinate the schedule, timeline, procurement, staffing, and budget of a product or service on a per project basis. Lead and guide the work of technical staff. May serve as a point of contact for the client or customer. Excludes "Management Occupations" (11-0000), "Logisticians" (13-1081), "Meeting, Convention, and Event Planners" (13-1121), and "Production, Planning, and Expediting Clerks" (43-5061).	Project management specialists usually work in an office setting. Although project management specialists may collaborate on teams, some work independently. Project management specialists also may travel to their clients' places of business.	781,400	56,300 (7%)
13-1111	Management Analysts	Conduct organizational studies and evaluations, design systems and procedures, conduct work simplification and measurement studies, and prepare operations and procedures manuals to assist management in operating more efficiently and effectively. Includes program analysts and management consultants. Excludes "Computer Systems Analysts" (15-1211) and "Operations Research Analysts" (15-2031).	Management analysts may travel frequently to meet with clients. Some work more than 40 hours per week.	950,600	108,400 (11%)
17-2071	Electrican Engineers	Research, design, develop, test, or supervise the manufacturing and installation of electrical equipment, components, or systems for commercial, industrial, military, or scientific use. Excludes "Computer Hardware Engineers" (17-2061).	Electrical and electronics engineers work in industries including research and development, engineering services, manufacturing, telecommunications, and the federal government. Electrical and electronics engineers generally work indoors in offices. However, they may have to visit sites to observe a problem or a piece of complex equipment.	303,800	9,800 (3%)
37-3011	Landscaping and Groundskeeping	Landscape or maintain grounds of property using hand or power tools or equipment. Workers typically perform a variety of tasks, which may include any combination of the following: sod laying, mowing, trimming, planting, watering, fertilizing, digging, raking, sprinkler installation, and installation of mortarless segmental concrete masonry wall units. Excludes "Farmworkers and Laborers, Crop, Nursery, and Greenhouse" (45-2092).	Most grounds maintenance work is done outdoors in all weather conditions. Some work is seasonal, available mainly in the spring, summer, and fall. The work may be repetitive and physically demanding, requiring frequent bending, kneeling, lifting, or shoveling.	1,299,000	61,300 (5%)
41-3091	Sales Representatives of Services	Sell services to individuals or businesses. May describe options or resolve client problems. Excludes "Advertising Sales Agents" (41-3011), "Insurance Sales Agents" (41-3021), "Securities, Commodities, and Financial Services Sales Agents" (41-3031), "Travel Agents" (41-3041), "Sales Representatives, Wholesale and Manufacturing" (41-4010), and "Telemarketers" (41-9041).	Wholesale and manufacturing sales representatives work under pressure because their income and job security depend on the amount of merchandise they sell. Some sales representatives travel frequently.	1,597,600	63,300 (4%)
43-3031	Bookkeeping, Accounting and Auditing	Compute, classify, and record numerical data to keep financial records complete. Perform any combination of routine calculating, posting, and verifying duties to obtain primary financial data for use in maintaining accounting records. May also check the accuracy of figures, calculations, and postings pertaining to business transactions recorded by other workers. Excludes "Payroll and Timekeeping Clerks" (43-3051).	Most accountants and auditors work full time. Overtime hours are typical at certain periods of the year, such as for quarterly audits or during tax season.	1,449,800	81,800 (6%)
47-1011	First-Line Supervisors of Construction Trades	Directly supervise and coordinate activities of construction or extraction workers.	N/A	735,500	29,900 (4%)

Table 10 – Occupational Description and Future Outlook (Cont.)

47-2061	Construction Laborers	Perform tasks involving physical labor at construction sites. May operate hand and power tools of all types: air hammers, earth tampers, cement mixers, small mechanical hoists, surveying and measuring equipment, and a variety of other equipment and instruments. May clean and prepare sites, dig trenches, set braces to support the sides of excavations, erect scaffolding, and clean up rubble, debris, and other waste materials. May assist other craft workers. Construction laborers who primarily assist a particular craft worker are classified under "Helpers, Construction Trades" (47-3010). Excludes "Hazardous Materials Removal Workers" (47-4041).	Most construction laborers and helpers typically work full time and do physically demanding work. Some work at great heights or outdoors in all weather conditions. Construction laborers have one of the highest rates of injuries and illnesses of all occupations.	1,572,200	69,500 (4%)
47-2073	Operating Engineers and Other Construction Equipment Operators	Operate one or several types of power construction equipment, such as motor graders, bulldozers, scrapers, compressors, pumps, derricks, shovels, tractors, or front-end loaders to excavate, move, and grade earth, erect structures, or pour concrete or other hard surface pavement. May repair and maintain equipment in addition to other duties. Excludes "Extraction Workers" (47-5000) and "Crane and Tower Operators" (53-7021).	Construction equipment operators may work even in unpleasant weather. Most operators work full time, and some have irregular work schedules that include nights.	466,900	22,000 (5%)
47-2111	Electricians	Install, maintain, and repair electrical wiring, equipment, and fixtures. Ensure that work is in accordance with relevant codes. May install or service street lights, intercom systems, or electrical control systems. Excludes "Security and Fire Alarm Systems Installers" (49-2098).	Almost all electricians work full time. Work schedules may include evenings and weekends. Overtime is common.	711,200	50,200 (7%)
47-2231	Solar Photovoltaic Installers	Assemble, install, or maintain solar photovoltaic (PV) systems on roofs or other structures in compliance with site assessment and schematics. May include measuring, cutting, assembling, and bolting structural framing and solar modules. May perform minor electrical work such as current checks. Excludes solar PV electricians who are included in "Electricians" (47-2111) and solar thermal installers who are included in "Plumbers, Pipefitters, and Steamfitters" (47-2152).	Most solar panel installations are done outdoors, but PV installers sometimes work in attics and crawl spaces to connect panels to the electrical grid. Installers also must travel to jobsites.	17,100	4,600 (27%)
47-3013	Helpers – Electricians	Help electricians by performing duties requiring less skill. Duties include using, supplying, or holding materials or tools, and cleaning work area and equipment. Construction laborers who do not primarily assist electricians are classified under "Construction Laborers" (47-2061). Apprentice workers are classified with the appropriate skilled construction trade occupation (47-2011 through 47-2231).	Most construction laborers and helpers typically work full time and do physically demanding work. Some work at great heights or outdoors in all weather conditions. Construction laborers have one of the highest rates of injuries and illnesses of all occupations.	1,572,200	69,500 (4%)
49-9071	Maintenance and Repair Workers, General (Operations)	Perform work involving the skills of two or more maintenance or craft occupations to keep machines, mechanical equipment, or the structure of a building in repair. Duties may involve pipe fitting; HVAC maintenance; insulating; welding; machining; carpentry; repairing electrical or mechanical equipment; installing, aligning, and balancing new equipment; and repairing buildings, floors, or stairs. Excludes "Facilities Managers" (11-3013) and "Maintenance Workers, Machinery" (49-9043).	General maintenance and repair workers often carry out many different tasks in a single day. They could work at any number of indoor or outdoor locations. They may work inside a single building, such as a hotel or hospital, or be responsible for the maintenance of many buildings, such as those in an apartment complex or on a college campus.	1,539,100	76,300 (5%)
51-1011	First-Line Supervisors of Production and Operating Workers	Directly supervise and coordinate the activities of production and operating workers, such as inspectors, precision workers, machine setters and operators, assemblers, fabricators, and plant and system operators. Excludes team or work leaders.	N/A	646,800	12,200 (2%)
51-8013	Power Plant Operators	Control, operate, or maintain machinery to generate electric power. Includes auxiliary equipment operators. Excludes "Nuclear Power Reactor Operators" (51-8011).	Most power plant operators, distributors, and dispatchers work full time. Many work rotating 8- or 12-hour shifts.	43,700	(6,500) (-15%)
53-7062	Laborers and Freight, Stock and Material Movers	Manually move freight, stock, luggage, or other materials, or perform other general labor. Includes all manual laborers not elsewhere classified. Excludes "Construction Laborers" (47-2061) and "Helpers, Construction Trades" (47-3011 through 47-3019). Excludes "Material Moving Workers" (53-7011 through 53-7199) who use power equipment.	Most hand laborers and material movers work full time. Because materials are shipped around the clock, some workers, especially those in warehousing, work overnight shifts.	6,473,000	358,300 (6%)

Table 11 – Occupational Output from IMPLAN Construction Model, Direct Jobs, Employment Greater than 1.0

Occ Code	Occupation	Wage and Salary Employment	Wage and Salary Income	Supplements to Wages and Salaries	Employee Compensation	Hours Worked
47-2000	Construction Trades Workers	157.38	$7,038,003.93	$1,298,698.42	$8,336,702.35	296,258.06
47-1000	Supervisors of Construction and Extraction Workers	22.66	$1,393,154.57	$257,073.98	$1,650,228.55	48,478.49
49-9000	Other Installation, Maintenance, and Repair Occupations	21.45	$932,887.11	$172,142.42	$1,105,029.53	41,598.32
13-1000	Business Operations Specialists	15.30	$1,027,151.68	$189,536.73	$1,216,688.42	30,805.68
11-9000	Other Management Occupations	11.44	$1,001,211.23	$184,750.03	$1,185,961.26	24,515.00
43-9000	Other Office and Administrative Support Workers	11.24	$348,138.71	$64,240.83	$412,379.53	18,036.61
11-1000	Top Executives	10.10	$963,668.18	$177,822.34	$1,141,490.52	22,573.38
47-3000	Helpers, Construction Trades	8.41	$256,294.14	$47,293.07	$303,587.21	14,377.95
43-3000	Financial Clerks	6.36	$249,005.71	$45,948.16	$294,953.87	11,175.99
43-6000	Secretaries and Administrative Assistants	6.11	$218,872.02	$40,387.69	$259,259.71	10,697.52
53-3000	Motor Vehicle Operators	6.03	$230,478.88	$42,529.47	$273,008.35	12,258.04
41-3000	Sales Representatives, Services	4.32	$237,763.71	$43,873.71	$281,637.42	8,592.23
53-7000	Material Moving Workers	3.78	$144,926.48	$26,742.78	$171,669.26	6,787.75
47-4000	Other Construction and Related Workers	3.62	$168,906.32	$31,167.70	$200,074.02	7,048.26
49-2000	Electrical and Electronic Equipment Mechanics, Installers, and Repairers	2.65	$116,014.02	$21,407.66	$137,421.68	5,289.66
49-1000	Supervisors of Installation, Maintenance, and Repair Workers	2.57	$162,435.84	$29,973.72	$192,409.56	5,590.94
17-2000	Engineers	2.54	$175,773.92	$32,434.95	$208,208.87	5,148.29
51-4000	Metal Workers and Plastic Workers	2.43	$109,738.23	$20,249.61	$129,987.84	4,780.24
43-4000	Information and Record Clerks	2.35	$74,387.92	$13,726.54	$88,114.47	3,869.84
13-2000	Financial Specialists	2.24	$150,254.00	$27,725.85	$177,979.85	4,480.24
49-3000	Vehicle and Mobile Equipment Mechanics, Installers, and Repairers	2.18	$100,588.54	$18,561.25	$119,149.79	4,562.33
43-1000	Supervisors of Office and Administrative Support Workers	1.95	$104,798.22	$19,338.05	$124,136.27	3,833.53
43-5000	Material Recording, Scheduling, Dispatching, and Distributing Workers	1.95	$77,271.75	$14,258.69	$91,530.44	3,747.56
11-3000	Operations Specialties Managers	1.51	$156,127.26	$28,809.62	$184,936.88	3,183.72
47-5000	Extraction Workers	1.34	$55,612.13	$10,261.91	$65,874.05	3,002.08
17-3000	Drafters, Engineering Technicians, and Mapping Technicians	1.24	$62,196.60	$11,476.92	$73,673.52	2,386.99
51-9000	Other Production Occupations	1.08	$40,271.78	$7,431.21	$47,702.99	1,976.96
41-4000	Sales Representatives, Wholesale and Manufacturing	1.01	$55,239.84	$10,193.22	$65,433.06	2,056.60

Table 12 – Occupational Output from IMPLAN Construction Model, Indirect Jobs, Employment Greater than 1.0

Occ Code	Occupation	Wage and Salary Employment	Wage and Salary Income	Supplements to Wages and Salaries	Employee Compensation	Hours Worked
17-2000	Engineers	3.88	$367,005.55	$52,152.64	$419,158.19	7,896.16
17-3000	Drafters, Engineering Technicians, and Mapping Technicians	2.26	$124,409.28	$17,689.21	$142,098.49	4,376.19
13-1000	Business Operations Specialists	1.84	$156,058.45	$22,546.11	$178,604.56	3,671.88
17-1000	Architects, Surveyors, and Cartographers	1.45	$113,113.58	$16,063.03	$129,176.60	2,892.71
15-1200	Computer Occupations	1.41	$137,124.23	$19,027.72	$156,151.95	2,791.90

Table 13 – Occupational Output from IMPLAN Construction Model, Induced Jobs, Employment Greater than 1.0

Occ Code	Occupation	Wage and Salary Employment	Wage and Salary Income	Supplements to Wages and Salaries	Employee Compensation	Hours Worked
41-2000	Retail Sales Workers	12.44	$265,120.32	$49,641.49	$314,761.80	15,948.79
35-3000	Food and Beverage Serving Workers	10.78	$161,056.61	$23,953.94	$185,010.56	11,141.71
53-7000	Material Moving Workers	8.07	$255,010.29	$46,469.71	$301,480.00	12,658.57
31-1100	Home Health and Personal Care Aides; and Nursing Assistants, Orderlies, and Psychiatric Aides	7.34	$167,606.65	$36,098.08	$203,704.73	11,253.87
29-1000	Healthcare Diagnosing or Treating Practitioners	6.47	$875,699.07	$178,341.03	$1,054,040.10	11,747.53
35-2000	Cooks and Food Preparation Workers	5.88	$107,364.95	$16,635.78	$124,000.73	7,674.94
43-4000	Information and Record Clerks	4.83	$167,395.99	$30,496.19	$197,892.19	7,774.71
53-3000	Motor Vehicle Operators	3.95	$178,164.03	$41,958.19	$220,122.22	7,564.12
29-2000	Health Technologists and Technicians	3.28	$158,051.20	$32,809.22	$190,860.43	5,744.33
13-1000	Business Operations Specialists	3.15	$205,456.44	$35,341.53	$240,797.97	6,024.49
11-1000	Top Executives	2.63	$245,046.49	$42,582.48	$287,628.97	5,616.49
31-9000	Other Healthcare Support Occupations	2.48	$102,909.36	$20,235.08	$123,144.44	3,887.53
49-3000	Vehicle and Mobile Equipment Mechanics, Installers, and Repairers	2.41	$121,542.89	$19,920.37	$141,463.26	4,651.81
43-3000	Financial Clerks	2.29	$92,768.87	$16,315.71	$109,084.58	3,949.95
43-6000	Secretaries and Administrative Assistants	2.26	$94,945.21	$18,053.25	$112,998.46	3,856.41
35-1000	Supervisors of Food Preparation and Serving Workers	2.19	$69,749.35	$10,396.57	$80,145.92	3,592.91
43-9000	Other Office and Administrative Support Workers	2.15	$70,596.57	$12,737.19	$83,333.76	3,398.32

Table 13 – Occupational Output from IMPLAN Construction Model, Induced Jobs, Employment Greater than 1.0 (Cont.)

Occ Code	Occupation	Wage and Salary Employment	Wage and Salary Income	Supplements to Wages and Salaries	Employee Compensation	Hours Worked
21-1000	Counselors, Social Workers, and Other Community and Social Service Specialists	2.10	$88,779.24	$17,746.46	$106,525.70	3,589.71
41-1000	Supervisors of Sales Workers	2.08	$95,089.22	$17,760.21	$112,849.42	4,048.05
35-9000	Other Food Preparation and Serving Related Workers	1.99	$25,788.96	$3,854.45	$29,643.41	1,810.52
13-2000	Financial Specialists	1.84	$150,637.86	$23,684.65	$174,322.51	3,722.32
37-2000	Building Cleaning and Pest Control Workers	1.80	$38,727.48	$7,449.74	$46,177.21	2,749.57
39-9000	Other Personal Care and Service Workers	1.70	$24,846.76	$4,689.03	$29,535.79	2,001.94
11-9000	Other Management Occupations	1.68	$140,278.56	$26,333.34	$166,611.90	3,283.03
15-1200	Computer Occupations	1.67	$145,925.85	$23,498.43	$169,424.27	3,267.48
43-5000	Material Recording, Scheduling, Dispatching, and Distributing Workers	1.51	$66,340.32	$19,545.41	$85,885.73	2,829.79
41-3000	Sales Representatives, Services	1.49	$89,244.62	$14,609.44	$103,854.06	2,995.67
49-9000	Other Installation, Maintenance, and Repair Occupations	1.40	$62,383.91	$13,766.22	$76,150.12	2,663.16
43-1000	Supervisors of Office and Administrative Support Workers	1.27	$75,370.19	$14,197.23	$89,567.42	2,410.43
11-3000	Operations Specialties Managers	1.06	$135,455.72	$22,856.88	$158,312.60	2,207.44
43-1000	Supervisors of Office and Administrative Support Workers	1.27	$75,370.19	$14,197.23	$89,567.42	2,410.43
11-3000	Operations Specialties Managers	1.06	$135,455.72	$22,856.88	$158,312.60	2,207.44
49-9000	Other Installation, Maintenance, and Repair Occupations	1.40	$62,383.91	$13,766.22	$76,150.12	2,663.16
43-1000	Supervisors of Office and Administrative Support Workers	1.27	$75,370.19	$14,197.23	$89,567.42	2,410.43
11-3000	Operations Specialties Managers	1.06	$135,455.72	$22,856.88	$158,312.60	2,207.44

X. Glossary

Bb

Battery Energy Storage Systems (BESS)

An array of hundreds or thousands of small batteries that enable energy from renewables, like solar and wind, to be stored and released at a later time.

Cc

Consumer Price Index (CPI)

An index of the changes in the cost of goods and services to a typical consumer, based on the costs of the same goods and services at a base period.

Dd

Direct impacts

During the construction period: the changes that occur in the onsite construction industries in which the direct final demand change is made.

During operating years: the final demand changes that occur in the onsite spending for the solar operations and maintenance workers.

Ee

Equalized Assessed Value (EAV)

The product of the assessed value of property and the state equalization factor. This is typically used as the basis for the value of property in a property tax calculation.

Ff

Farming profit

The difference between total revenue (price multiplied by yield) and total cost regarding farmland.

Full-time equivalent (FTE)

A unit that indicates the workload of an employed person. One FTE is equivalent to one worker working 2,080 hours in a year. One half FTE is equivalent to a half-time worker or someone working 1,040 hours in a year.

Hh

HV line extension

High-voltage electric power transmission links used to connect generators to the electric transmission grid.

Ii

IMPLAN (IMpact analysis for PLANning)

A business who is the leading provider of economic impact data and analytic applications. IMPLAN data is collected at the federal, state, and local levels and used to create state-specific and county-specific industry multipliers.

Indirect impacts

Impacts that occur in industries that make up the supply chain for that industry.

During the construction period: the changes in inter- industry purchases resulting from the direct final demand changes, including construction spending on materials and wind farm equipment and other purchases of good and offsite services.

During operating years: the changes in inter-industry purchases resulting from the direct final demand changes.

Induced impacts

The changes that occur in household spending as household income increases or decreases as a result of the direct and indirect effects of final demand changes.

Inflation

A persistent rise in the general level of prices related to an increase in the volume of money and resulting in the loss of value of currency. Inflation is typically measured by the CPI.

Mm

Median Household Income (MHI)

The income amount that divides a population into two equal groups, half having an income above that amount, and half having an income below that amount.

Millage rate

The tax rate, as for property, assessed in mills per dollar.

Multiplier

A factor of proportionality that measures how much a variable changes in response to a change in another variable.

MW

A unit of power, equal to one million watts or one thousand kilowatts.

MWac (megawatt alternating current)

The power capacity of a utility-scale solar PV system after its direct current output has been fed through an inverter to create an alternating current (AC). A solar system's rated MWac will always be lower than its rated MWdc due to inverter losses. AC is the form in which electric energy is delivered to businesses and residences and that consumers typically use when plugging electric appliances into a wall socket.

MWdc (megawatt direct current)

The power capacity of a utility-scale solar PV system before its direct current output has been fed through an inverter to create an alternating current. A solar system's rated MWdc will always be higher than its rated MWac.

Nn

Net economic impact

Total change in economic activity in a specific region, caused by a specific economic event.

Net Present Value (NPV)

Cash flow determined by calculating the costs and benefits for each period of investment.

NREL's Jobs and Economic Development Impacts (JEDI) Model

An input-output model that measures the spending patterns and location-specific economic structures that reflect expenditures supporting varying levels of employment, income, and output.

Oo

Output

Economic output measures the value of goods and services produced in a given area. Gross Domestic Product is the economic output of the United States as a whole.

Pp

PV (photovoltaic) system

Solar modules, each comprising a number of solar cells, which generate electrical power.

Rr

Real Gross Domestic Product (GDP)

A measure of the value of goods and services produced in an area and adjusted for inflation over time.

Real-options analysis

A model used to look at the critical factors affecting the decision to lease agricultural land to a company installing a solar powered electric generating facility.

Ss

Stochastic

To have some randomness.

Tt

Tax rate

The percentage (or millage) of the value of a property to be paid as a tax.

Total economic output

The quantity of goods or services produced in a given time period by a firm, industry, county, or country.

Uu

Utility-scale solar

Solar powered-electric generation facilities intended for wholesale distribution typically over 5MW in capacity.

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XII. Curriculum Vitae (Abbreviated)

David G. Loomis
Illinois State University
Department of Economics
Campus Box 4200
Normal, IL 61790-4200
(815) 905-2750
dloomis@ilstu.edu

Education

Doctor of Philosophy, Economics, Temple University, Philadelphia, Pennsylvania, May 1995.

Bachelor of Arts, Mathematics and Honors Economics, Temple University, Magna Cum Laude, May 1985.

Experience

1996-present Illinois State University, Normal, IL
Full Professor – Department of Economics (2010-present)
Associate Professor - Department of Economics (2002-2009)
Assistant Professor - Department of Economics (1996-2002)

- Taught Regulatory Economics, Telecommunications Economics and Public Policy, Industrial Organization and Pricing, Individual and Social Choice, Economics of Energy and Public Policy and a Graduate Seminar Course in Electricity, Natural Gas and Telecommunications Issues.
- Supervised as many as 5 graduate students in research projects each semester.
- Served on numerous departmental committees.

1997-present Institute for Regulatory Policy Studies, Normal, IL
Executive Director (2005-present)
Co-Director (1997-2005)

- Grew contributing membership from 5 companies to 16 organizations.
- Doubled the number of workshop/training events annually.
- Supervised 2 Directors, Administrative Staff and internship program.
- Developed and implemented state-level workshops concerning regulatory issues related to the electric, natural gas, and telecommunications industries.

2006-2018 Illinois Wind Working Group, Normal, IL
Director

- Founded the organization and grew the organizing committee to over 200 key wind stakeholders
- Organized annual wind energy conference with over 400 attendees
- Organized strategic conferences to address critical wind energy issues
- Initiated monthly conference calls to stakeholders
- Devised organizational structure and bylaws

2007-2018 Center for Renewable Energy, Normal, IL
Director

- Created founding document approved by the Illinois State University Board of Trustees and Illinois Board of Higher Education.
- Secured over $150,000 in funding from private companies.
- Hired and supervised 4 professional staff members and supervised 3 faculty members as Associate Directors.
- Reviewed renewable energy manufacturing grant applications for Illinois Department of Commerce and Economic Opportunity for a $30 million program.
- Created technical "Due Diligence" documents for the Illinois Finance Authority loan program for wind farm projects in Illinois.

2011-present Strategic Economic Research, LLC
President

- Performed economic impact analyses on policy initiatives and energy projects such as wind energy, solar energy, natural gas plants and transmission lines at the county and state level.
- Provided expert testimony before state legislative bodies, state public utility commissions, and county boards.
- Wrote telecommunications policy impact report comparing Illinois to other Midwestern states.
- Published 40 articles in leading journals such as AIMS Energy, Renewable Energy, National Renewable Energy Laboratory Technical Report, Electricity Journal, Energy Economics, Energy Policy, and many others
- Testified over 80 times in formal proceedings regarding wind, solar and transmission projects
- Raised over $7.7 million in grants
- Raised over $2.7 million in external funding

Bryan A. Loomis
Strategic Economic Research, LLC
Vice President

Education

Master of Business Administration (M.B.A.), Marketing and Healthcare, Belmont University, Nashville, Tennessee, 2017.

Experience

2019-present Strategic Economic Research, LLC, Bloomington, IL
Vice President
(2021-present)
Property Tax Analysis and Land Use Director
(2019-2021)

- Directed the property tax analysis by training other associates on the methodology and overseeing the process for over twenty states
- Improved the property tax analysis methodology by researching various state taxing laws and implementing depreciation, taxing jurisdiction millage rates, and other factors into the tax analysis tool
- Executed land use analyses by running Monte Carlo simulations of expected future profits from farming and comparing that to the solar lease
- Performed economic impact modeling using JEDI and IMPLAN tools
- Improved workflow processes by capturing all tasks associated with economic modeling and report-writing, and created automated templates in Asana workplace management software

2019-2021 Viral Healthcare Founders LLC, Nashville, TN
CEO and Founder

- Founded and directed marketing agency for healthcare startups
- Managed three employees
- Mentored and worked with over 30 startups to help them grow their businesses
- Grew an email list to more than 2,000 and LinkedIn following to 3,500
- Created a Slack community and grew to 450 members
- Created weekly video content for distribution on Slack, LinkedIn and Email

Christopher Thankan
Strategic Economic Research, LLC
Economic Analyst

Education

Bachelor of Science in Sustainable & Renewable Energy (B.A.), Minor in Economics, Illinois State University, Normal, IL, 2021

Experience

2021-present Strategic Economic Research, LLC, Bloomington, IL
Economic Analyst

- Create economic impact results on numerous renewable energy projects Feb 2021-Present
- Utilize IMPLAN multipliers along with NREL's JEDI model for analyses
- Review project cost Excel sheets
- Conduct property tax analysis for different US states
- Research taxation in states outside research portfolio
- Complete ad hoc research requests given by the president
- Hosted a webinar on how to run successful permitting hearings
- Research school funding and the impact of renewable energy on state aid to school districts
- Quality check coworkers JEDI models
- Started more accurate methodology for determining property taxes that became the main process used

Strategic Economic Research, LLC

by Dr. David G. Loomis,
Bryan Loomis, and Chris Thankan
Strategic Economic Research, LLC
strategiceconomic.com
815-905-2750