

# Pennsylvania Solar: Stable, High-paying, Local jobs

## 100% Local

All construction, operations, and maintenance labor is local.



Productive use of hillsides,  
Washington County, PA

## High Wages

Solar projects provide stable, high-paying, local jobs.

In Pennsylvania, solar employment grew eight percent from 2017 to 2019. At the end of 2019, solar jobs accounted for 35 percent of the state's clean energy generation workforce.



**\$64K - \$175K Construction**



**\$69K Equipment & Supply Chain**



**\$72K Onsite Labor**

## 2,600 to 3,000 Jobs created with every 100 MW of solar

Solar projects generate direct jobs in construction and operations, as well as supply chain jobs for the materials and equipment. Communities gain jobs from the spending of those workers in the community, contributing to the vibrancy of restaurants and retail.



York County, PA

## New income to support PA Farmers

Solar projects provide additional income streams for landowners and farmers, while complementing agriculture activities like livestock grazing, and making use of non-productive hillsides. The revenue from lease payments stabilizes the income of Pennsylvania's farmers and ensures a brighter future for the state's farm economy.

### Solar income for farmers

**\$20k/year** for a 5 MW project

**\$110k/year** for a 20 MW project

# How does solar benefit your community?



Animals grazing amid solar panels

100 MW of solar power in PA means...

**2,400**  
construction jobs

**200-600**  
permanent operations jobs

## A 5 MW project

- requires **27.5** acres of land
- powers **780** homes

## A 20 MW project

- requires **110** acres of land
- powers **3,120** homes



### Local

Solar energy is locally produced and locally used.



### Stable

Solar costs do not fluctuate based on market dynamics of supply and demand.



### Secure

Solar can limit disruptions for communities during emergencies and natural disasters.

## With solar, many communities throughout Pennsylvania benefit.

The distribution of solar projects throughout the state provides power, jobs, and economic benefits in many more communities.

## Maximize the benefits to your community:

- Provide farmers with new revenue sources
- Bolster local tax revenues
- Create permanent, high-wage jobs

## Investing in jobs of the future

Communities throughout Pennsylvania are embracing solar energy.

Expanding solar development creates a demand for more jobs. If Pennsylvania does not act now, we will lose out on the future growth of this emerging industry.

## PA: An Energy Leader

- #1** provider of electricity to other states
- #2** natural gas-producing state
- #3** net supplier of energy to other states
- #3** coal-producing state
- Top 3** in electricity production
- #32** in solar energy production

# What does a solar project mean for a community?

Solar projects provide stable, high-paying, local jobs.



**\$64K - \$175K** for Construction & Installation Workers

**\$69K** for Equipment & Supply Chain Workers

**\$72K** for Onsite Labor

In Pennsylvania, solar employment grew eight percent from 2017 to 2019. At the end of 2019, solar jobs accounted for 35 percent of the state's clean energy generation workforce. Some other key facts about solar energy jobs:

- 100% of construction, operations, and maintenance labor is local
- The distributed nature of solar projects and solar energy production means that more communities benefit from these jobs.

## Solar Projects: Economic Impacts

### 5 MW Solar Project

Local Economic Impacts - Summary Results

During construction period	Jobs	Earnings (\$M)	Output (\$M)	Value Added (\$M)
Project Development and Onsite Labor Impacts	47	\$6.60	\$8.82	\$7.22
Construction and Interconnection Labor	32	\$5.63	n/a	n/a
Construction Related Services	15	\$0.97	n/a	n/a
Equipment and Supply Chain Impacts	42	\$2.92	\$11.82	\$5.92
Induced Impacts	37	\$2.37	\$6.31	\$3.57
<b>Total Impacts</b>	<b>126</b>	<b>\$11.89</b>	<b>\$26.95</b>	<b>\$16.71</b>

During operating years (annual)	Jobs	Earnings (\$M)	Output (\$M)	Value Added (\$M)
Onsite Labor Impacts	20	\$1.44	\$1.44	\$1.44
Local Revenue and Supply Chain Impacts	4	\$0.31	\$1.00	\$0.65
Induced Impacts	4	\$0.30	\$0.79	\$0.49
<b>Total Impacts</b>	<b>29</b>	<b>\$2.05</b>	<b>\$3.23</b>	<b>\$2.58</b>

Notes: Earnings and Output values are millions of dollars in 2021 dollars. Construction period related jobs are full-time equivalent for the construction period. Plant workers include operators, maintenance, administration and management. Economic impacts "During operating years" represent impacts that occur from plant operations/expenditures. The analysis does not include impacts associated with spending of plant "profits" and assumes no tax abatement unless noted. Totals may not add up due to independent rounding. Induced effects are the values stemming from household spending of Labor Income, after removal of taxes, savings, and commuter income. The induced effects are generated by the spending of the employees within the business' supply chain.

Read more about the [JEDI Models for Solar Project Impacts](#).



## 20 MW Solar Project

During construction period	Jobs	Earnings (\$M)	Output (\$M)	Value Added (\$M)
Project Development and Onsite Labor Impacts	177	\$24.76	\$33.10	\$27.10
Construction and Interconnection Labor	121	\$21.14	n/a	n/a
Construction Related Services	57	\$3.62	n/a	n/a
Equipment and Supply Chain Impacts	158	\$10.96	\$44.39	\$22.21
Induced Impacts	138	\$8.89	\$23.68	\$13.41
<b>Total Impacts</b>	<b>474</b>	<b>\$44.62</b>	<b>\$101.17</b>	<b>\$62.72</b>

During operating years (annual)	Jobs	Earnings (\$M)	Output (\$M)	Value Added (\$M)
Onsite Labor Impacts	24	\$1.67	\$1.67	\$1.67
Local Revenue and Supply Chain Impacts	10	\$0.74	\$2.34	\$1.29
Induced Impacts	7	\$0.48	\$1.28	\$0.77
<b>Total Impacts</b>	<b>42</b>	<b>\$2.89</b>	<b>\$5.29</b>	<b>\$3.73</b>

## Statewide Growth in Solar

### Innovative Solar Projects

#### Penn State Mont Alto 70 MW Solar Project

**Penn State Powered by the Sun: [Solar Projects at Penn State - Penn State Sustainability Institute](#)**

In 2019, Penn State entered into a 25 year Solar PPA (Power Purchase Agreement) with Lightsource bp. This 70 MW project uses more than 150,000 solar panels sited across 3 locations in Franklin County near Penn State's Mont Alto campus. The project went into service October 2020 and provides 25% of Penn State's state-wide electricity requirements.<sup>2</sup> Since the three sites began operation through June 1, 2021, the system has generated nearly 75 million kWh of electricity.<sup>3</sup> Beyond the energy produced, and the cost savings, the solar array provides educational and career opportunities to grow the industry: [Penn State's new solar array creates student research and intern opportunities](#).

#### State Government Stabilizes Energy Costs - Pennsylvania PULSE

**[Solar Project to Produce Half of State Government's Electricity](#)**

In March 2021, Pennsylvania announced an initiative to produce half of the state government's electricity from solar power. Seven projects, equaling 191 megawatts (MW) of solar power are expected to produce 361,000 MWh of electricity per year to supply the energy for 16 state agencies. This initiative provides a number of benefits, including fixed, stable electricity costs for 15 years, insulating the state from future energy price increases.

<sup>2</sup> [Solar Projects at Penn State - Penn State Sustainability Institute](#). Undated. Accessed on June 2, 2021.

<sup>3</sup> Dashboard Portals: [Nittany 1](#), [Nittany 2](#), and [Nittany 3](#). Accessed on June 2, 2021. Data on generation through June 1, 2021.

## Sample Solar Projects Across PA

It is difficult to predict when and where all of the planned solar projects will be completed, but there are already a diverse array of solar projects in communities throughout Pennsylvania:

- [Sites for York Co. and Juniata Co. solar farms revealed](#)
- [Solar farm project possible in Piney | News | thecourierexpress.com](#)
- [80-acre solar farm in Franklin County](#)
- [Growth in solar power sparks a land rush](#)

Each solar project is different, but they often have one thing in common: they generally lease the land on which they are located. Various sources have reported lease rates, and while they vary by location, and electrical service provider, they generally range between \$300 and \$2,000 per acre depending on the location.<sup>4</sup>

Solar projects require 3-7 acres of total land per MW for utility scale solar projects. The exact acreage depends on the solar technology and scale generation. Assuming an average of 5.5 acres per MW based on a study by NREL and input from solar developers, and a lease rate of \$1,000 per acre, a 5 MW solar project would require 27.5 acres and generate lease income between \$19,250 to \$27,500 per year. A 20 MW solar project would require 110 acres and generate lease income between \$77,000 and \$100,000 per year.<sup>5</sup>

Solar projects located on less productive land provide a double benefit to farmers and landowners by diversifying and increasing their revenue stream.

*"It's our most marginal land," said Ed Johnson, a third-generation farm owner in Easton, Washington County. Most of his land is leased to other farmers but the income from the new Branscomb solar farm being built by CS Energy pays about 20 times what cropland would pay.<sup>6</sup>*

## Solar Growth Drives the Need for Workers

In April 2021, the Pennsylvania Department of Environmental Protection (DEP) released the report, produced by the BW Research Partnership. The [PA 2021 Clean Energy Workforce Development Needs Assessment & Gap Analysis](#) estimated that Pennsylvania's solar employment grew 8 percent (+396 jobs) from 2017 through 2019, despite declines in the national solar workforce. At the end of 2019, solar jobs accounted for 35 percent of the state's clean energy generation workforce. According to the report, Pennsylvania has just over 550 MW of installed solar capacity. The DEP's 2018 target of achieving 10 percent solar electricity generation by 2030 would require an additional 11 gigawatts (GW) of generation capacity over the next decade.

<sup>4</sup> See [What's the average solar farm lease rate?](#) Undated. Accessed on June 1, 2021.

<sup>5</sup> Ong, Sean, et al. (2013) Land-Use Requirements for Solar Power Plants in the United States. National Renewable Energy Laboratory. Available from <https://www.nrel.gov/docs/fy13osti/56290.pdf>.

<sup>6</sup> Karlin, Rick, Rick Karlin. (May 6, 2021) [Growth in solar power sparks a land rush](#), accessed on May 20, 2021.

# Energy Leadership is an Investment in our Future

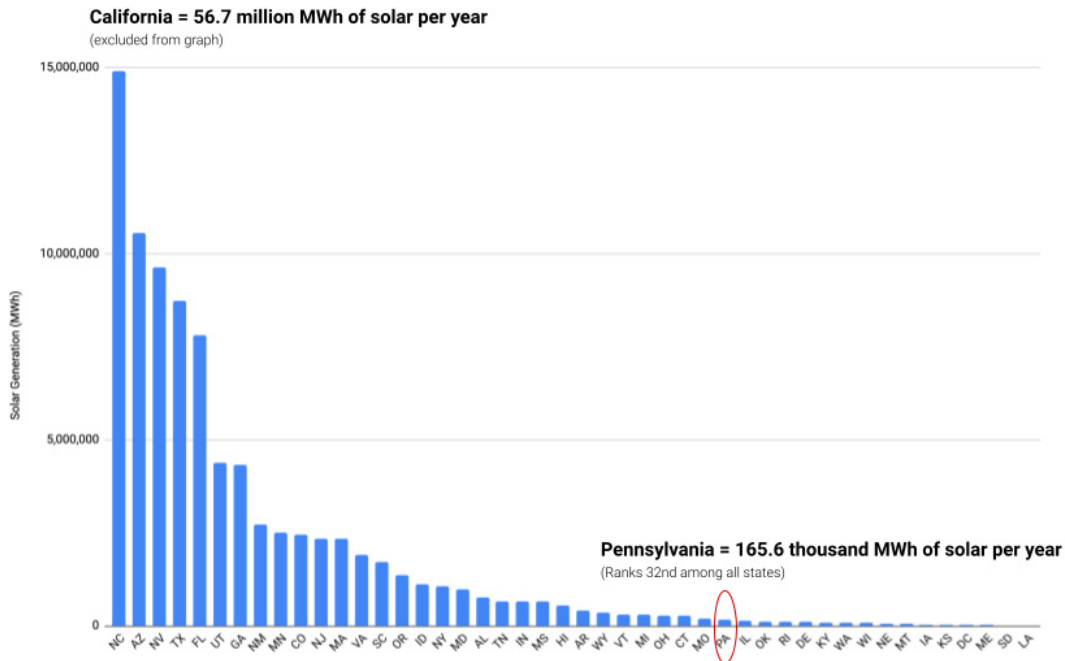


## PA Energy Facts

Pennsylvania is the **third-largest producer of electricity in the nation**, behind only Texas and Florida.<sup>1</sup> Electricity generation regularly exceeds Pennsylvania's power consumption, and the state exports more electricity outside its borders than any other state.<sup>2</sup>

Pennsylvania ranks 32nd in terms of solar power production, generating 165.6 thousand MWh of solar per year. By prioritizing solar development, the state is able to keep pace with the demand for solar and continue as a leader in the energy industry.

Currently, only 18% of solar array components are manufactured in Pennsylvania. An increase in solar development presents the opportunity for job growth throughout the supply chain, as communities throughout Pennsylvania embrace solar energy. If Pennsylvania does not act now, the state will lose out on the future growth of this emerging industry.



1 76 U.S. EIA, Electric Power Monthly (February 2020), Table 1.3.B.

2 State Energy Portal, Pennsylvania Analysis. See <https://www.eia.gov/beta/states/states/pa/analysis>. Accessed April 29, 2021.

# Solar Methodology



## About the JEDI Models for Solar Project Impacts

Fourth Economy used the JEDI Models from the National Renewable Energy Laboratory (NREL) to estimate the impact of the potential solar projects that could be developed across Pennsylvania. For the amount of solar energy production, Fourth Economy estimated 3.5 kWh/kWp based on estimates from the [Global Solar Atlas](#), which generally align with the estimates from [NREL](#).<sup>1</sup>

Other than inputting the location as Pennsylvania and the estimate for the Solar Direct Normal Resource, Fourth Economy used the model's default values. Sample Inputs for the 20 MW Solar Project are provided here:

## Project Descriptive Data

Project Location	PENNSYLVANIA
Solar Direct Normal Resource (kWh/m2/day)	3.50
Year of Construction	2021
Project Size - Nameplate Capacity (MW)	20
Solar Field Aperture Area (square meters)	155,273
Plant Capacity Factor	20.7%
Construction Cost (\$/KW)	\$6,750
Annual Operations and Maintenance Cost (\$/kW)	\$142.15
Money Value - Current or Constant (Dollar Year)	2021

## Project Cost Data - Default Values

Construction Costs	Cost	Cost per KW	Percent of total cost	Local Share
Materials				
Construction (concrete rebar, equip, roads and site prep)	\$3,602,229	\$180	2.6%	95%
Materials Subtotal	\$3,602,229	\$180	2.6%	
Labor				
Sitework and Infrastructure	\$1,016,291	\$51	0.7%	100%
Field Erection	\$12,147,719	\$607	8.6%	100%
Support Structures	\$717,694	\$36	0.5%	100%
Piping	\$3,963,140	\$198	2.8%	100%
Electrical	\$1,581,246	\$79	1.1%	100%
Labor Subtotal	\$19,426,090	\$971	13.79%	
Construction Subtotal	\$23,028,319	\$1,151	16.3%	
Equipment Costs	Cost	Cost per KW	Percent of total cost	Local Share
Mirrors	\$7,987,808	\$399	5.7%	0%
Heat Collection Elements	\$25,326,472	\$1,266	18.0%	0%
Thermal Energy Storage Tanks	\$7,354,248	\$368	5.2%	42%
Heat Exchangers	\$5,463,594	\$273	3.9%	0%
Heat Transfer System Equipment	\$4,482,097	\$224	3.2%	34%
Heat Transfer and Storage Fluids	\$15,819,143	\$791	11.2%	10%
Steam Turbines & Generators	\$10,689,726	\$534	7.6%	12%
Misc. Electrical and Solar Equipment (pumps, motors, drive, etc.)	\$359,928	\$18	0.3%	59%
Water Treatment	\$311,374	\$16	0.2%	50%
Metal Support Structure	\$4,796,027	\$240	3.4%	50%
Interconnection Piping	\$6,968,372	\$348	4.9%	59%
Electronics & Controls	\$2,409,021	\$120	1.7%	50%
Balance of Plant	\$2,748,506	\$137	2.0%	50%
Equipment Subtotal	\$94,716,316	\$4,736	67.2%	

<sup>1</sup> 1 kWh/kWp refers to how much energy a solar array or module can produce. Pennsylvania ranges from 3.4 to 3.97 kWh/kWp.



<b>Other Costs</b>	<b>Cost</b>	<b>Cost per KW</b>	<b>Percent of total cost</b>	<b>Local Share</b>
Freight & Transportation	\$0	\$0	0.0%	50%
Engineering & Project Management	\$13,988,062	\$699	9.9%	50%
Misc. Costs (permitting, licensing, legal)	\$3,260,937	\$163	2.3%	50%
Other Subtotal	\$17,248,999	\$862	12.2%	
<b>Subtotal</b>	<b>\$134,993,633</b>	<b>\$6,750</b>	<b>95.8%</b>	
Sales Tax (Materials & Equipment Purchases)	\$5,899,113	\$295	4.2%	100%
<b>Total for Construction</b>	<b>\$140,892,746</b>	<b>\$7,045</b>	<b>100.0%</b>	

### Annual Operating and Maintenance Costs

<b>Personnel</b>	<b>Cost</b>	<b>Cost per KW</b>	<b>Percent of total cost</b>	<b>Local Share</b>
Operations	\$493,818	\$24.69	17.4%	100%
Administrative	\$789,600	\$39.48	27.8%	100%
Power Plant Maintenance	\$262,941	\$13.15	9.2%	100%
Field Maintenance	\$250,982	\$12.55	8.8%	100%
Personnel Subtotal	\$1,797,341	\$89.87	63.2%	
<b>Materials and Services</b>				
Water	\$110,731	\$5.54	3.9%	100%
Water Treatment (Chemicals)	\$28,751	\$1.44	1.0%	50%
Misc. Services	\$129,876	\$6.49	4.6%	100%
Utilities	\$69,328	\$3.47	2.4%	100%
Fuel (motor vehicle gasoline)	\$0	\$0.00	0.0%	100%
Field Parts and Materials and Plant Equip	\$707,022	\$35.35	24.9%	50%
Misc. Supplies & Equipment	\$0	\$0.00	0.0%	50%
Materials and Services Subtotal	\$1,045,708	\$52.29	36.8%	
<b>Total O&amp;M Costs</b>	<b>\$2,843,049</b>	<b>\$51</b>	<b>100.0%</b>	

### Other Parameters

<b>Financial Parameters</b>	<b>Cost</b>	<b>Local Share</b>
Debt Financing		
Percentage financed	60%	100%
Years financed (term)	20	100%
Interest rate	10%	100%
Equity Financing/Repayment		
Percentage equity	40%	
Individual Investors (percent of total equity)	0%	100%
Corporate Investors (percent of total equity)	100%	50%
Return on equity (annual interest rate)	6%	100%
Repayment term (years)	30	100%
<b>Financial Parameters</b>		
Local Property Tax Rate (percent of taxable value)	0%	50%
Assessed value (percent of construction cost)	100%	50%
Taxable Value (percent of assessed value)	100%	
Taxable Value	\$140,892,746	
Local Property Taxes	\$0	
Local Sales Tax Rate	6.00%	
<b>Insurance</b>		
Percentage of Capital Cost	0.5%	
Insurance Cost	\$704,464	0%
<b>Land Purchase Parameters</b>		
Land Purchase Cost (per acre)	\$2,000	
Number of acres	129	
Land Purchase (total cost)	\$258,788	
Percentage financed	90%	100%
Years financed (term)	30	
Interest rate	6.5%	
<b>Land Lease Parameters</b>		
Land Lease Cost (per acre)	\$0	
Number of acres	129	
Land Lease (total cost)	\$0	
Lease Payment Recipient (F = farmer/household, O = Other)	F	100%

Notes: 1) The JEDI model estimated 129 acres for a 20 MW solar project, which equates to 6.45 acres per MW. Fourth Economy used 5.5 acres per MW based on a project range of 4 to 7 acres per MW. Our estimate is therefore more conservative on the land requirement as well as lease income. 2) The estimate does not assume any changes in local property taxes. Projects located on tax exempt land may be converted to taxable land, but those local siting and taxing decisions were not included in the estimates. Furthermore, no assumptions were made regarding the potential change in the value of the land before and after the solar project development.



# Definitions

## Earnings

Earnings reflect the combined cost of total payroll paid to employees (e.g. wages and salaries, benefits, payroll taxes) and payments received by self-employed individuals and/or unincorporated business owners across the defined economy.

This includes wages and salaries, all benefits (e.g., health, retirement) and payroll taxes (both sides of social security, unemployment insurance taxes, etc.). It is also referred to as fully-loaded payroll.

## Proprietor Income

Proprietor Income (PI) is also included in earnings. PI consists of payments received by self-employed individuals and unincorporated business owners. More specifically, it represents the current-production income of sole proprietorships, partnerships, and tax-exempt cooperatives. It includes the capital consumption allowance and is recorded on Federal Tax form 1040C. It excludes dividends, monetary interest received by nonfinancial business, and rental income received by persons not primarily engaged in the real estate business. Note that Labor Income can be negative if there is a net loss to the proprietor.

See more at [Understanding Labor Income \(LI\), Employee Compensation \(EC\), and Proprietor Income \(PI\)](#).

## Understanding the Jobs and Impacts Estimated by the JEDI Model.

More information and the definitions for key concepts are available from [Interpreting JEDI Results](#) and summarized below.

### Construction and Interconnection Labor

These jobs are calculated based on cost and local share information entered in the JEDI model for the following fields: Foundation, Erection, Electrical, Management/Supervision, and HV Sub/Interconnection Labor. This includes the following kinds of workers: crane operators, road contractors, construction managers, electricians, tower erectors, excavation workers, backhoe operators, foundation workers, installation workers

The jobs for construction related services are calculated based on cost and local share information entered in the Engineering and Legal Services fields in the JEDI model. This includes the following kinds of workers: civil and electrical engineers, attorneys, permitting specialists

### Supply Chain Impacts

Supply chain impacts include the materials and equipment necessary for the solar project (e.g., turbines, modules, and boilers), as well as various components that are required (e.g., wiring, inverters, mountings, and transformers). The supply chain impacts are derived from spending on project development, on-site labor (hard hat purchases), equipment costs, manufacturing of components required to produce these components, materials, and the various inputs required to produce these materials. The supply chain impacts also include expenses such as land easements, site certificate/permitting, and miscellaneous labor.<sup>2</sup>