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.[1]

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%	

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

Other Costs	Cost	Cost per KW	Percent of total cost	Local Share
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%	
Subtotal	**$134,993,633**	**$6,750**	**95.8%**	
Sales Tax (Materials & Equipment Purchases)	$5,899,113	$295	4.2%	100%
Total for Construction	**$140,892,746**	**$7,045**	**100.0%**	

Annual Operating and Maintenance Costs

Personnel	Cost	Cost per KW	Percent of total cost	Local Share
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%	
Materials and Services				
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%	
Total O&M Costs	**$2,843,049**	**$51**	**100.0%**	

Other Parameters

Financial Parameters	Cost	Local Share
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%
Financial Parameters		
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%	
Insurance		
Percentage of Capital Cost	0.5%	
Insurance Cost	$704,464	0%
Land Purchase Parameters		
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%	
Land Lease Parameters		
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.[2]

2 Interpreting JEDI Results | Jobs and Economic Development Impact Models. Accessed April 29, 2021.