

Updating Data for Small Solar PV

Bill

Data	Example	Units	Definition
Region	South	text	What region is the hypothetical plant in, NW,SW,MW,S,GL,SE,NE
State	Texas	text	What state within the region is the hypothetical plant
Generator type	Wind	text	What type of energy generator is the plant
Construction Time	9mo	Months	How long would a project take from groundbreaking till production, does it scale with capacity
Land Requirements	200ac	Acres	How much visible space is required for a plant of X size area needed scale linearly or as a step function
Regulatory Hurdles	Mid (NEPA)	(L/M/H)	How many potential regulations need to be considered. ex. nuclear waste, environmental, ecological, ...
Interconnection Challenges	High (remote)	(L/M/H)	How far is the generation area from nearby interconnection, can the generator be in or around cities
Total Costs	\$20m	\$Million	All costs that must be considered before a plant comes online.
Construction costs	\$18.75m	\$Million	Materials and Labor to make the Power plant
Tax Credits	\$750,000	\$Dollars	Any Green tax credits that may apply, federal, state, or local
Permitting and validation costs	\$2m	\$Million	Other costs associated with getting a constructed plant operational
Capacity	10MW	MW	Nameplate capacity, what the plant is rated for
Capacity Factor	45%	%	Percentage that measures how much energy a generating unit or plant produces compared to its maximum output
Maintenance and Operation Costs	\$6,000,000	\$	Fixed costs associated with keeping plants up and running
Variable Costs	\$200	\$/MWh	Costs that scale with plant output. ex. Labor, water, lubricant
Fuel Costs	0	\$/BTU	A specific type of variable costs converted to BTU for consistency
Expected Lifetime	25yr	Years	How long the plant plans to run as well as the minimum, maximum, and std dev estimated
Discount Rate	10%	%	What is the value of future money, takes inflation and monetary growth into account
Potential policy updates and changes	Mid (IRA)	(L/M/H)	Are there regulations or incentives that may affect costs or revenue throughout the life of the plant
Storage costs or downtime factor	\$10M - (80%)	\$ - %	How much would it cost to store the recommended percentage of the plant's capacity for when its down
Startup/shutdown costs	\$0	\$	Any costs associated with turning off or starting up power plants
Comparable existing generation types prices	\$0.33	\$	Used to calculate LACE, existing plants of comparable capacity of different types by lowest cost
Potential revenue	\$100M	\$M/yr	Ballpark gross revenue based on PPAs or regional energy costs
Summer capacity vs winter capacity	7.3MW-3.4MW	MW	Many plants generate different amounts during different seasons due to temp/weather changes, what's the delta

Small Scale Solar in CA

Data	Example	Source
Region	South West	<i>User Defined</i>
State	California	<i>User Defined</i>
Generator type	Solar PV	User Defined

Physical Requirements

Data	Example	Source
Construction Time	2mo/MW + y	https://oyarenewables.com/faq/how-long-does-it-take-to-develop-and-construct-a-solar-farm/#:~:text=Generally%2C%20for%20a%202%2D5,municipal%20permitting%20and%20approval%20processes.
Land Requirements	7a/MW	https://coldwellsolar.com/commercial-solar-blog/how-much-investment-do-you-need-for-a-solar-farm/#:~:text=According%20to%20GTM%20Research%2C%201,just%20the%20solar%20installations%20themselves.
Regulatory Hurdles	High (permitting, siting, NEPA, CEQA)	https://opr.ca.gov/docs/20190226-Solar_Permitting_Guidebook_4th_Edition.pdf https://daltontomich.com/solar-farms-and-the-legal-landscape-navigating-regulatory-requirements/
Interconnection Challenges	MID	Singular ISO, relatively connected grid

CAPEX

Data	Example	Source
Total Costs	\$0.95M/MW	https://www.nrel.gov/docs/fy22osti/83586.pdf https://ratedpower.com/blog/solar-farm-costs/#soft-costs
Material costs	\$0.64M/MW	https://www.marketwatch.com/guides/solar/solar-farm-cost/
Construction costs	\$0.23M/MW	https://www.marketwatch.com/guides/solar/solar-farm-cost/
State Tax Credits	Only residential	
Federal Tax credits	\$20.5/MW	https://www.irs.gov/pub/irs-pdf/p5886.pdf https://www.resources.org/archives/tax-credit-choice-for-solar-and-wind-power-in-the-inflation-reduction-act/
Permitting and Inspection costs	\$.04/MW	\$Million
Land Cost est.	\$2000/ac	https://www.land.com/California/all-land/over-20-acres/sort-price-low/

Plant Specifics

Data	Example	Source : notes
Capacity	7MW	User Defined
Capacity Factor	24%	https://emp.lbl.gov/pv-capacity-factors : capacity factor increased through insulation, tuning and tracking https://www.eia.gov/todayinenergy/detail.php?id=39832
Maintenance and Operation Costs	\$22,000/MW-yr	https://www.nrel.gov/docs/fy20osti/74840.pdf https://atb.nrel.gov/electricity/2023/utility-scale_pv
Variable Costs	\$20	https://www.resources.org/common-resources/what-are-costs-and-values-wind-and-solar-power-how-are-they-changing/
Fuel Costs	0	\$/BTU
Expected Lifetime	25yr	https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/us-solar-farm-lifespans-lengthen-driving-energy-prices-down-58892859
Residual Value	?????	???????????????????????????????? (when would it make more sense to upgrade to a new plant)
Storage costs or downtime factor	\$10M - (80%)	\$ - %
Startup/shutdown costs	\$0	\$

Financial Analysis

Data	Example	Source
Discount Rate	7%	https://energyeducation.ca/encyclopedia/Discounting
Potential policy updates and changes	Mid (IRA)	(L/M/H)
Comparable existing generation types prices	\$0.33	https://www.caiso.com/generation-transmission/generation -vary by time of use
Potential revenue	\$280,000/yr	https://www.solarreviews.com/blog/what-is-a-solar-farm-do-i-need-one https://8billiontrees.com/solar-panels/solar-farm-income-per-acre/ -theoretically the same for all sources in a competitive market -delta between capex and alternative energy price - ** "Value Created" **
Summer capacity vs winter capacity	33%-12% (2.31-.84MW)	https://www.spglobal.com/marketintelligence/en/news-insights/research/2022-monthly-us-solar-capacity-factors-underscore-winter-doldrums
Hourly generation curve	normal	https://www.sce.com/sites/default/files/inline-files/PRP_SolarDependabilityWhitePaper.pdf

Next steps

- Fill data to CSV
- Translate CSV to json
- Import data to github

Best Data Sources

- NREL Studies
- EIA Data
- GOV Data
- ISO Data
- <https://emp.lbl.gov/>