System Advisor Model (SAM) PV Scenario Analysis Example

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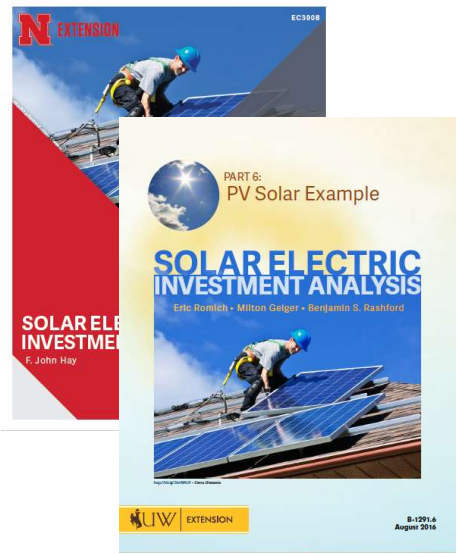
Objectives



Validate
Replicate analysis described in PV Solar Example for Ohio

Test
Try changing some parameters to see if results match expectations

Learn
Practice good modeling techniques

Use scenarios to set boundaries

Table 1: PV Solar Example Details

Variables	Scenario 1: Aggressive Proposal	Scenario 2: Conservative Proposal
System Cost	$31,000	$31,000
30% Investment Tax Credit	$9,300	$9,300
SREC Payment (10 years)	$2,500 (Income tax not applied)	$2,500 (Income tax applied)
Grant	25% USDA REAP Grant (Income tax not applied)	$0
System Performance: Degradation	0.25% annually	0.50% annually
Operations and Maintenance Costs	$0/year	$20 per KW annually plus 2% annual inflation and 1% escalation
Insurance Costs	$0/year	0.5% of system cost plus 2% annual inflation
Energy Rate	.11¢ per kWh flat	Actual rate structure that includes a fixed monthly charge, time of use charges, and demand charges.
Energy Price Escalation Rate (real)	6% annually	1% annually
Inflation Rate	2% annually	2% annually
Discount Rate	4% annually	4% annually
Depreciation	5-year Modified Accelerated Cost Recovery System	5-year Modified Accelerated Cost Recovery System

Find boundaries to a problem: Value of proposed system should be within bounds of worst and best case scenarios.

Tasks

1. Run a default case to see results
2. Replicate aggressive scenario
3. Replicate conservative scenario
4. Discuss modifications for other localities

Techniques we will practice

1. Model a basic PV system
2. Model a commercial project
3. Download weather and electricity rate data from online databases
4. Estimate load data
5. Work with system costs and financial assumptions
6. Interpret results
7. Use cases to compare scenarios
8. Perform parametric studies

Practice run

1. Start SAM
2. Create PVWatts/Commercial case
3. Run a simulation to see results
4. Modify inputs for aggressive scenario
5. Run simulation, and compare results to document.
6. Fix any problems
7. Duplicate case
8. Modify inputs for conservative scenario
9. Run simulation, compare results
10. Fix problems
11. Discuss modifications for other localities

Scenario analysis

1. Modify inputs for aggressive scenario
2. Run simulation and compare results to document
3. Fix any problems
4. Duplicate case
5. Modify inputs for conservative scenario
6. Run simulation, compare results
7. Fix problems
8. Discuss modifications for other localities

Base assumptions

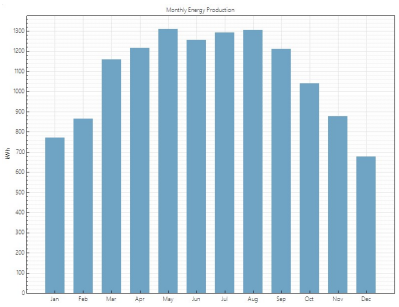
- Columbus, Ohio
- 10 kW system, 40 degree tilt
- Ohio Power Company Secondary General Service GS-2
- 5,200 kWh/mo winter, 1,690 kWh/mo summer load

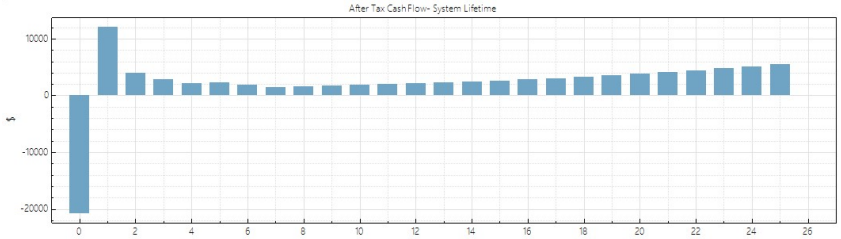
Aggressive scenario inputs

- $3.10/W system cost, 0 O&M cost
- 0.25%/year degradation rate
- No debt, 25 year project
- 2% inflation, 4% real discount rate
- 30% federal, 7% state income tax rates
- No sales tax, insurance, property tax
- 5-yr MACRS depreciation
- 30% federal ITC, $2,500 state IBI, 25% federal IBI (not taxable)

Aggressive scenario results

Metric	Value
Annual energy (year 1)	12,983 kWh
Capacity factor (year 1)	14.8%
Energy yield (year 1)	1,298 kWh/kW
Levelized COE (nominal)	2.58 ¢/kWh
Levelized COE (real)	2.10 ¢/kWh
Electricity bill without system (year 1)	$3,602
Electricity bill with system (year 1)	$2,174
Net savings with system (year 1)	$1,428
Net present value	$22,375
Payback period	3.9 years
Discounted payback period	4.3 years
Net capital cost	$20,750
Equity	$20,750
Debt	$0





Conservative scenario inputs

- $3.10/W system cost, 20 O&M cost
- 0.5%/year degradation rate
- No debt, 25 year project
- 2% inflation, 4% real discount rate
- 30% federal, 7% state income tax rates
- No sales tax, 0.5% insurance, no property tax
- 5-yr MACRS depreciation
- 30% federal ITC, $2,500 state IBI

Aggressive scenario results

Metric	Value
Annual energy (year 1)	12,983 kWh
Capacity factor (year 1)	14.8%
Energy yield (year 1)	1,298 kWh/kW
Levelized COE (nominal)	10.46 ¢/kWh
Levelized COE (real)	8.54 ¢/kWh
Electricity bill without system (year 1)	$5,201
Electricity bill with system (year 1)	$3,866
Net savings with system (year 1)	$1,335
Net present value	$-2,485
Payback period	14.4 years
Discounted payback period	NaN
Net capital cost	$28,500
Equity	$28,500
Debt	$0