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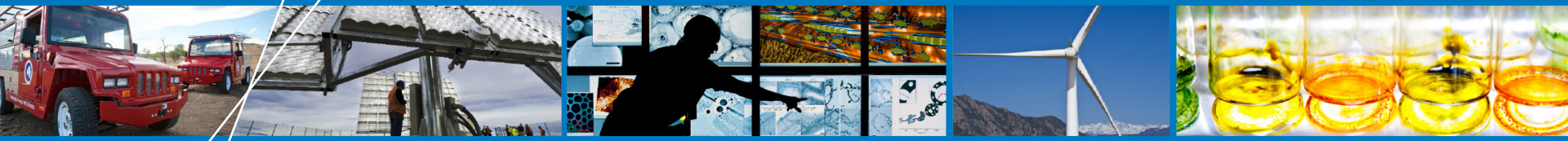
NATIONAL RENEWABLE ENERGY LABORATORY

Third Party Ownership Modeling in SAM



Nate Blair and the SAM Team

August 19th, 2015

SAM Webinar Schedule for 2015

System Advisor Model

- **Introduction to New SAM!**
  - Nov 20, 2014: Janine Freeman
- **Sizing Photovoltaic Systems in SAM**
  - Dec 18, 2014: Janine Freeman
- **Parametric and Statistical Analysis in SAM**
  - Jan 22, 2015: Paul Gilman
- **Modeling Power Towers in SAM**
  - Feb 19, 2015: Mike Wagner
- **Scripting in SAM with LK**
  - Mar 19, 2015: Aron Dobos
- **Modeling Wind Systems in SAM**
  - Apr 16, 2015: Janine Freeman
- **SAM's Residential Third Party Financial Model**
  - Aug 20, 2015: Nate Blair
- **Battery Storage for PV Systems in SAM**
  - Sep 17, 2015: Aron Dobos

Details

- All sessions last one hour and begin at 1 p.m. Mountain Time
- You must register to participate
- Registration is free, but space is limited
- More details and registration information on Learning page of SAM website

https://sam.nrel.gov/videos

Outline

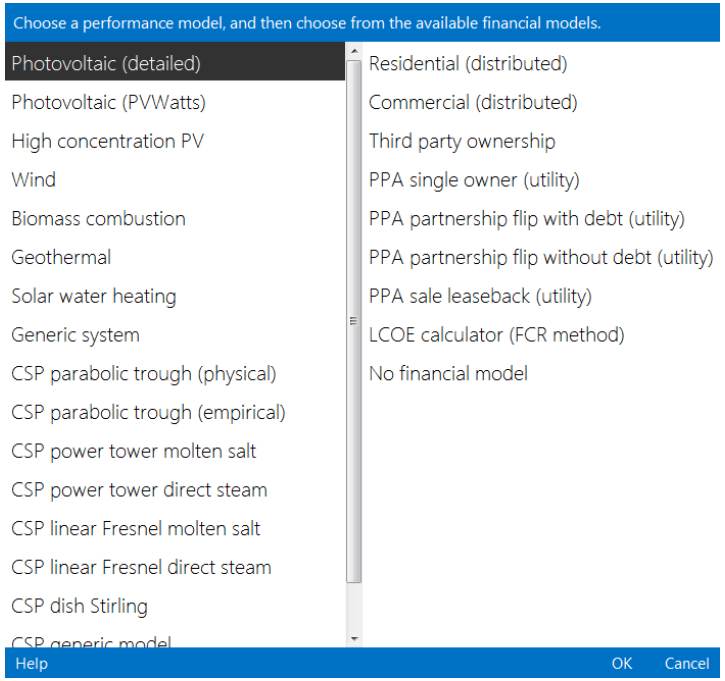
- Background on Financial Models in SAM
- Overview of SAM Third Party Ownership Model
- Demonstration
- Questions

This webinar is most useful if you have…

- Familiar with distributed PV modeling in SAM
- Familiar with existing residential financial model in SAM
- Interested in third party ownership financial models.

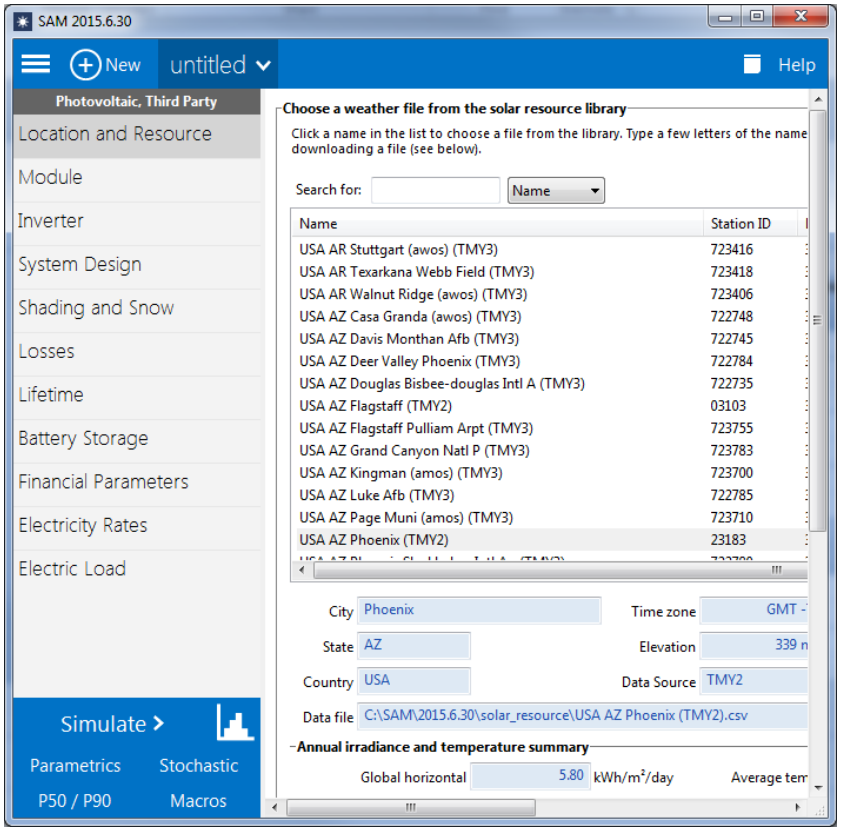
Assumptions for Previous Financial Models

- **Current financial models for distributed PV focus on the "owner" of the system.**
  - Commercial building owner
  - Residential homeowner
- **All calculations are done from the perspective of that entity.**
  - Tax credits, other incentives, tax rates
- **Outputs (NPV, LCOE, etc.) are also from the perspective of the system owner.**
- **The third-party ownership model in SAM departs from this approach significantly.**



Key Points regarding the Third Party Ownership Model

- Project costs and benefits are from the customer (residential or commercial property owner) perspective NOT the third-party owner
- User can enter either a lease payment or PPA payment.
- The system reduces the customer's electricity bill, and the customer makes payments to the third party owner for the system.
- In a power purchase agreement (PPA), the customer pays for the power generated by the system at a fixed rate called the PPA price.
- In a lease agreement, the customer makes monthly lease payments on the system.
- Many of the typical SAM input pages go away (Incentives, Depreciation, most financial inputs)



Why did we implement the TPO Model in this way?

- Significant growth in third party ownership systems raises many analysis questions which could be answered by SAM
- We realized we would not be able to get accurate cost/financing assumptions from within TPO companies.

Request from users (external and NREL-internal) to:

- Investigate the value of different electricity rate structures and load profiles under a third party ownership agreement.
- Investigate the sensitivity of the NPV to variations in inflation, discount rate, net metering changes, etc.
- Compare the benefit of a lease agreement to a PPA
- Compare the TPO model to the Residential or Commercial model to compare third party and direct ownership.

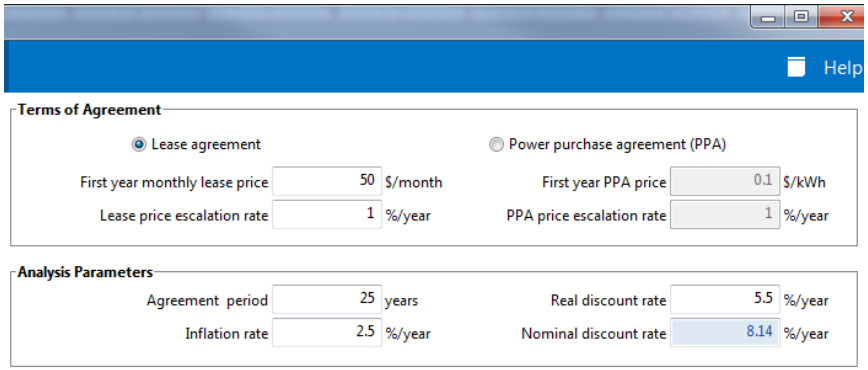
TPO Inputs from a TPO proposal

Lease agreement - The customer makes fixed monthly lease payments for the system.

- **First year monthly lease price**
  - For a lease agreement, the amount of the customer's fixed monthly payments in the first year of the agreement period.
- **Lease price escalation rate**
  - For a lease agreement, the annual increase in the monthly lease payments. If the lease price is constant over the agreement period, enter an escalation rate of zero.

Power purchase agreement (PPA) - The customer makes monthly payments for the electricity generated by the system.

- **First year PPA price**
  - For a PPA, the price of electricity generated by the system paid by the customer in the first year of the agreement period.
- **PPA price escalation rate**
  - For a PPA, the annual increase in the PPA price. If the PPA price is constant over the lease agreement period, enter an escalation rate of zero.



TPO Inputs that might impact the NPV

Agreement period

- The number of years in the lease agreement or PPA. This is the period over which the system operates and the customer makes payments to the third party owner.

Inflation rate

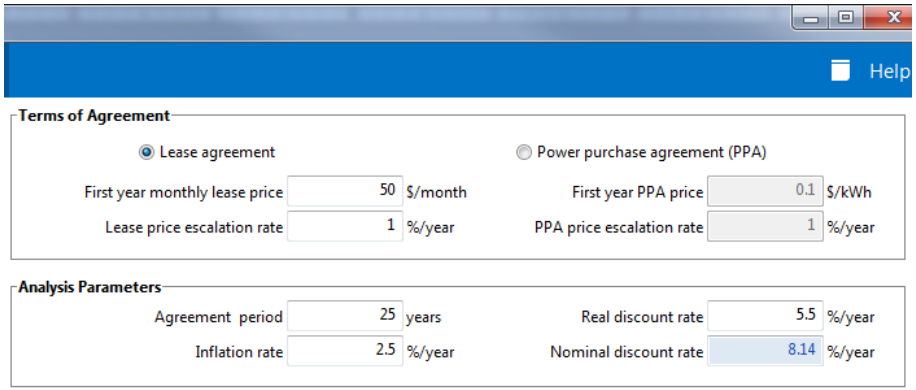
- The annual rate of inflation. Inflation applies to the electricity rates paid by the customer as defined on the Electricity Rates page. It does not apply to the lease payments.

Real discount rate

- A measure of the time value of money expressed as an annual rate.

Nominal discount rate

- SAM calculates the nominal discount based on the values of the real discount rate and the inflation rate, and uses this value to calculate the project's net present value:
- Nominal Discount Rate = (1 + Real Discount Rate) × (1 + Inflation Rate) - 1



TPO Key Outputs

Net present value

- The net present value is the present value of the annual cash flow, and represents the net savings over the agreement term. In general, a positive net present value represents a project that generates enough savings to justify the agreement cost. A negative net present value indicates a project whose cost is greater than the savings.

Annual Results

- The annual results appear in the Data table under Annual Data.

Annual cost

- The annual cost of the agreement. For a lease agreement, it is the sum of monthly lease payments for each year in the agreement period. For a PPA, it is the sum of electricity payments for each year.

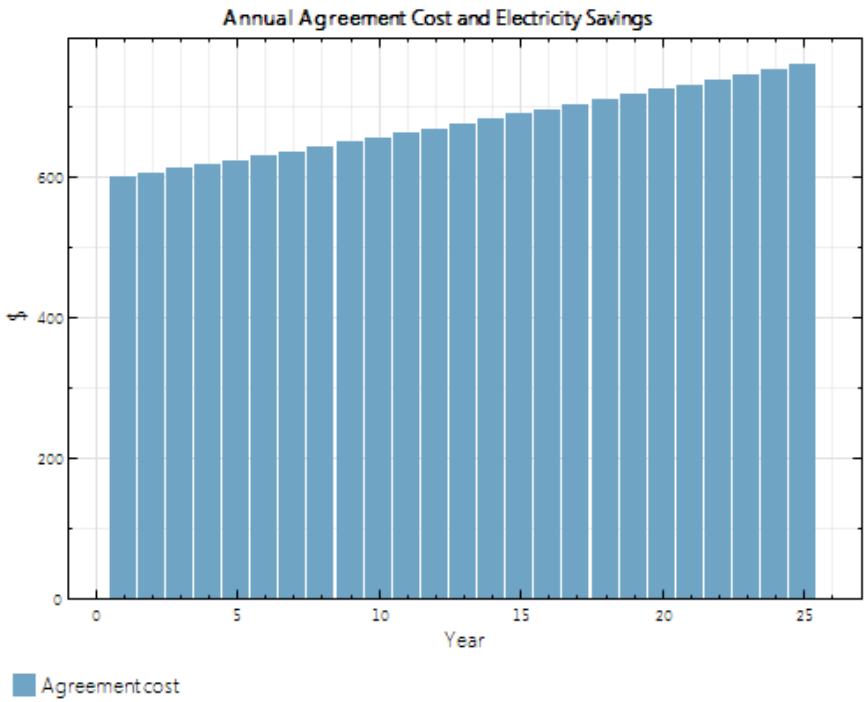
Energy value in each year

- The value of the electricity purchases offset by the renewable energy system, or the annual reduction in the customer's electricity bill.

Cash flow

- The net cost of the agreement, equal to the annual savings minus lease payments.

Metric	Value
Annual energy	6,856 kWh
Capacity factor	20.2%
First year kWhAC/kWDC	1,770 kWh/kW
Performance ratio	0.75
Net present value	$3,426



Demonstration

- **Walk through a typical analysis.**

- **Assume:**
  - PPA Price: 9.5 c/kwh
  - PPA Escalation: 3%/year
  - Location: Lakewood CO
  - 10 kW PV system with SunPower modules
  - Xcel Energy residential rate

Conclusion

- NREL has added new capabilities to SAM allowing the user to investigate the financing and economics related to third party ownership.
- NREL isn't saying anything about the financing within a third-party-owner company
- This capability and the simple LCOE (based on a fixed charge rate) are two significant additions on the finance modeling part of SAM.

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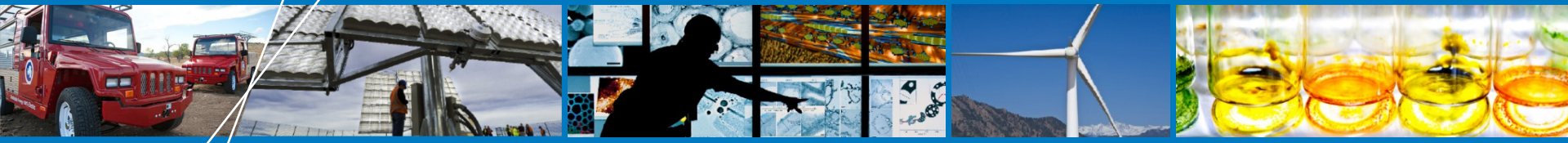

Questions!