
Are Photovoltaic Systems Worth More to Residential Consumers on Net Metered Time-of-Use Rates?

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Objective

- Overall objective is to determine if PV systems have higher value under Time-of-Use (TOU) rates than under non-TOU (standard) rates
- Demonstrate risks of performing a simplistic analysis
- Perform a case study using a PG&E customer
- Extend results throughout U.S

Simplistic example - PV worth \$125 more on TOU rate structure

STANDARD RATE

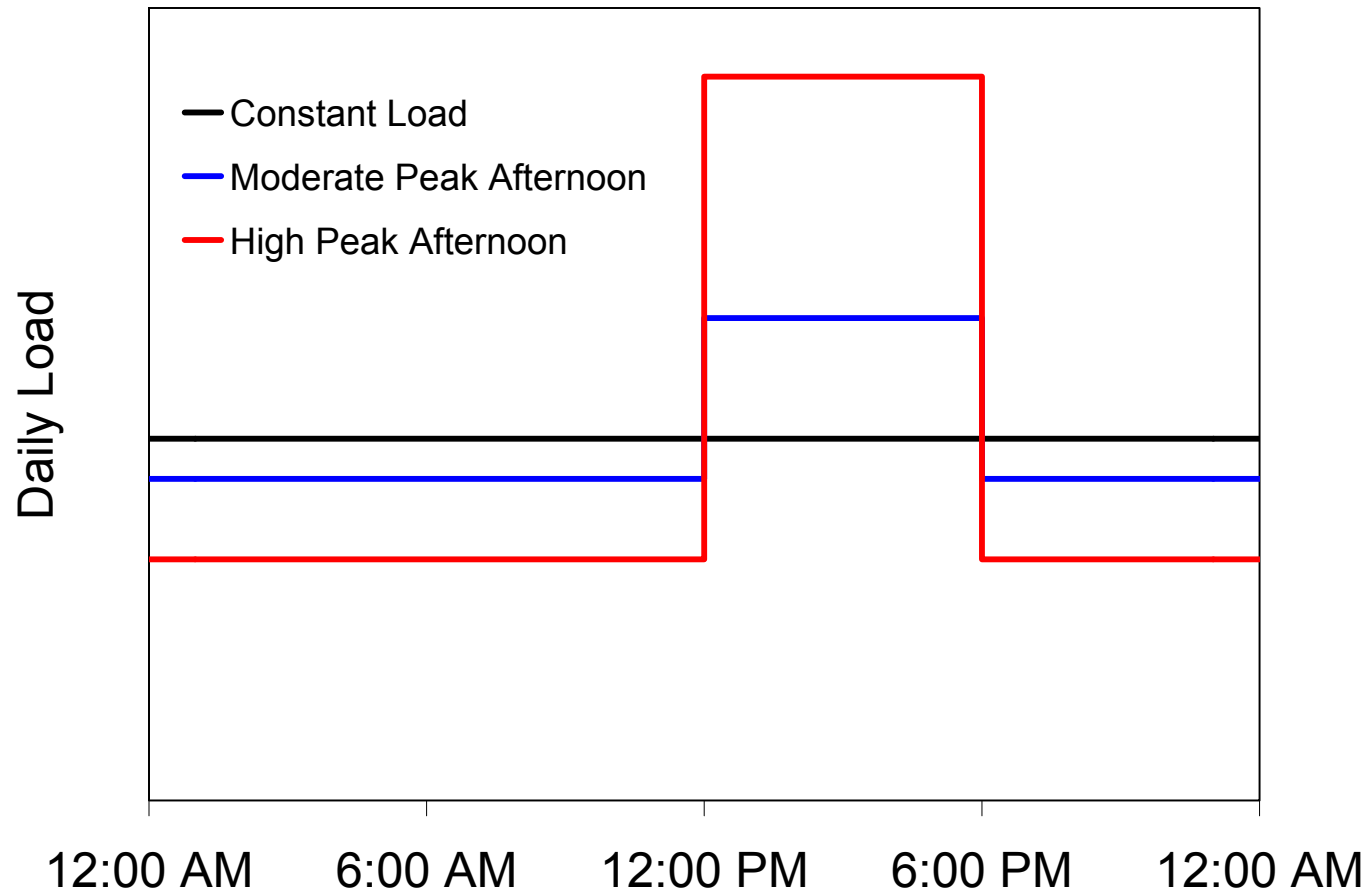
	Noon to 6 PM	6 PM to Noon
PV Output	2,500	2,500
Standard Rate	\$0.10	\$0.10
Subtotal		
	\$250	\$250
Total Savings		\$500

TOU RATE

	Noon to 6 PM	6 PM to Noon
PV Output	2,500	2,500
TOU Rate	\$0.20	\$0.05
Subtotal		
	\$500	\$125
Total Savings		\$625

\$125 more on TOU

Simplistic example - does not account for load profile & rate switch



Utility bill savings depends on load profile for TOU rate

Simplistic Analysis	\$625
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Detailed Analysis	
High Afternoon Peak Load	\$375
Constant Load	\$750
Moderate Afternoon Peak Load	\$625

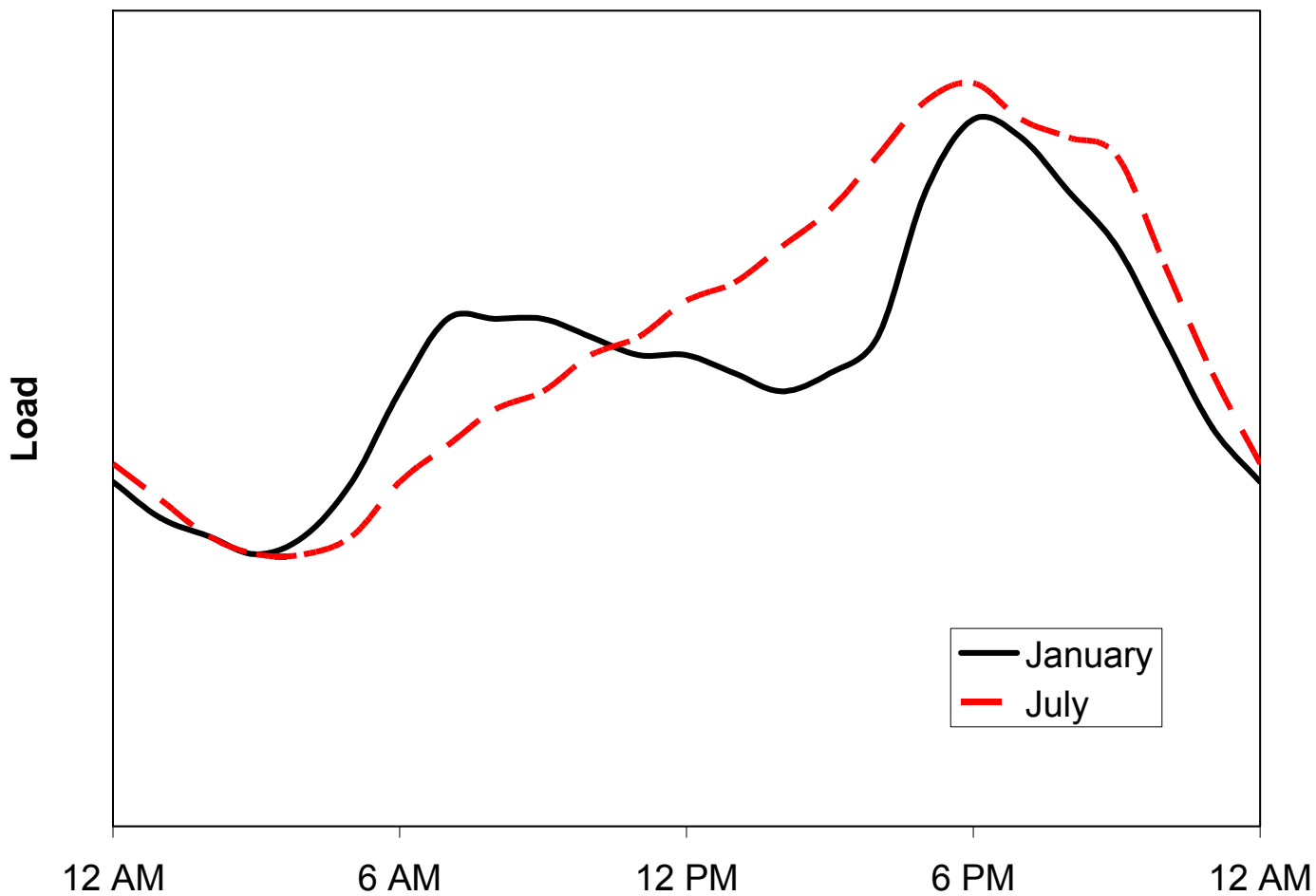
Clean Power Estimator bill savings estimation methodology

1. Calculate existing utility bill using current load profile and rate structure
(load profile consists of a 24-hour day for each month of the year)
2. Modify load profile based on PV system output for a particular system size, orientation, and shading factors
(PV output consists of a 24-hour day for each month of the year)
3. Calculate proposed utility bill using modified load profile and proposed rate structure
4. Utility bill savings equals current bill minus proposed bill

PG&E case study assumptions

- Residential customer in San Jose, CA (PG&E)
- Typical PG&E E-1 load profile
- Switch from standard rate (E-1) to TOU rate (E-7)
- QuickQuotes (powered by Clean Power Estimator analysis engine) is the analysis tool

Daily load profile used in analysis

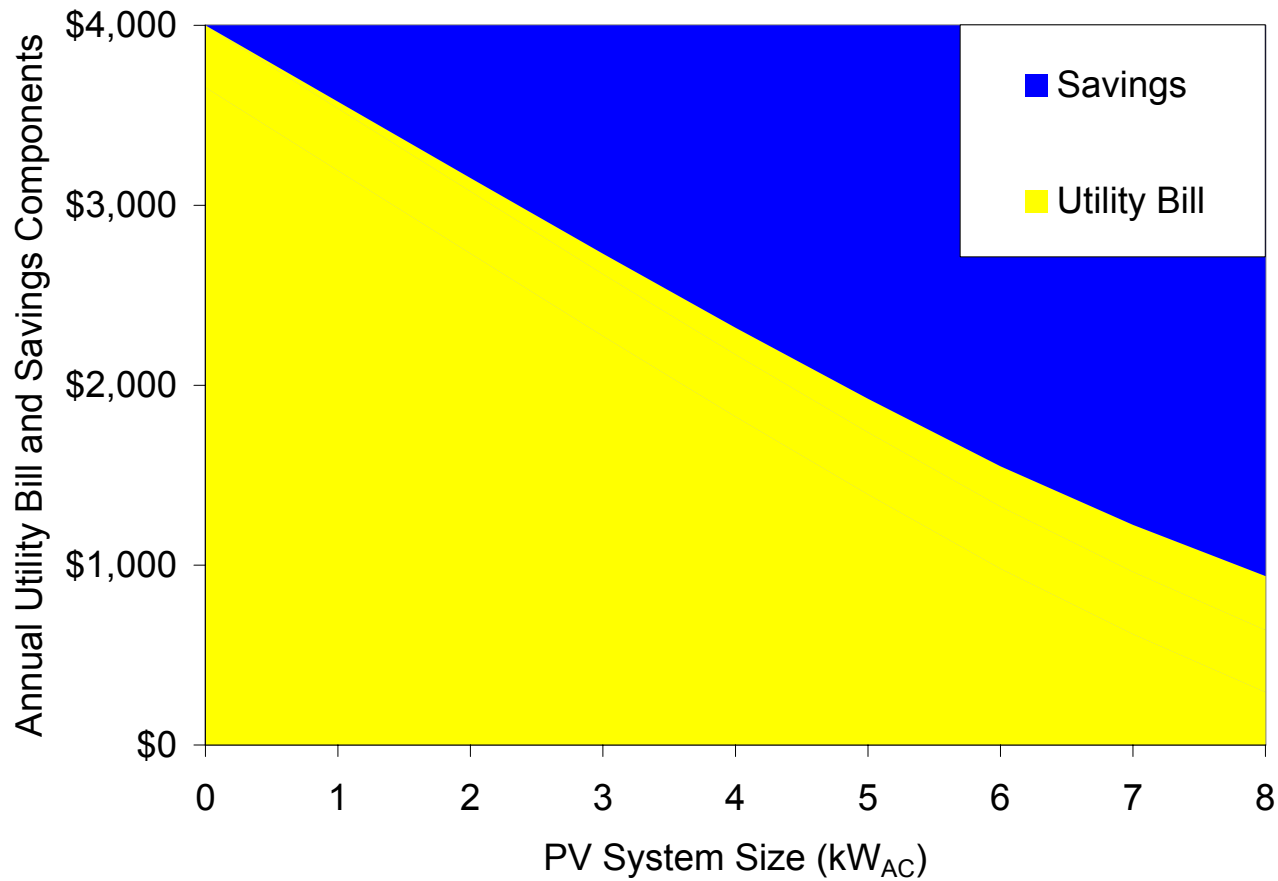


PG&E rate structures used in analysis

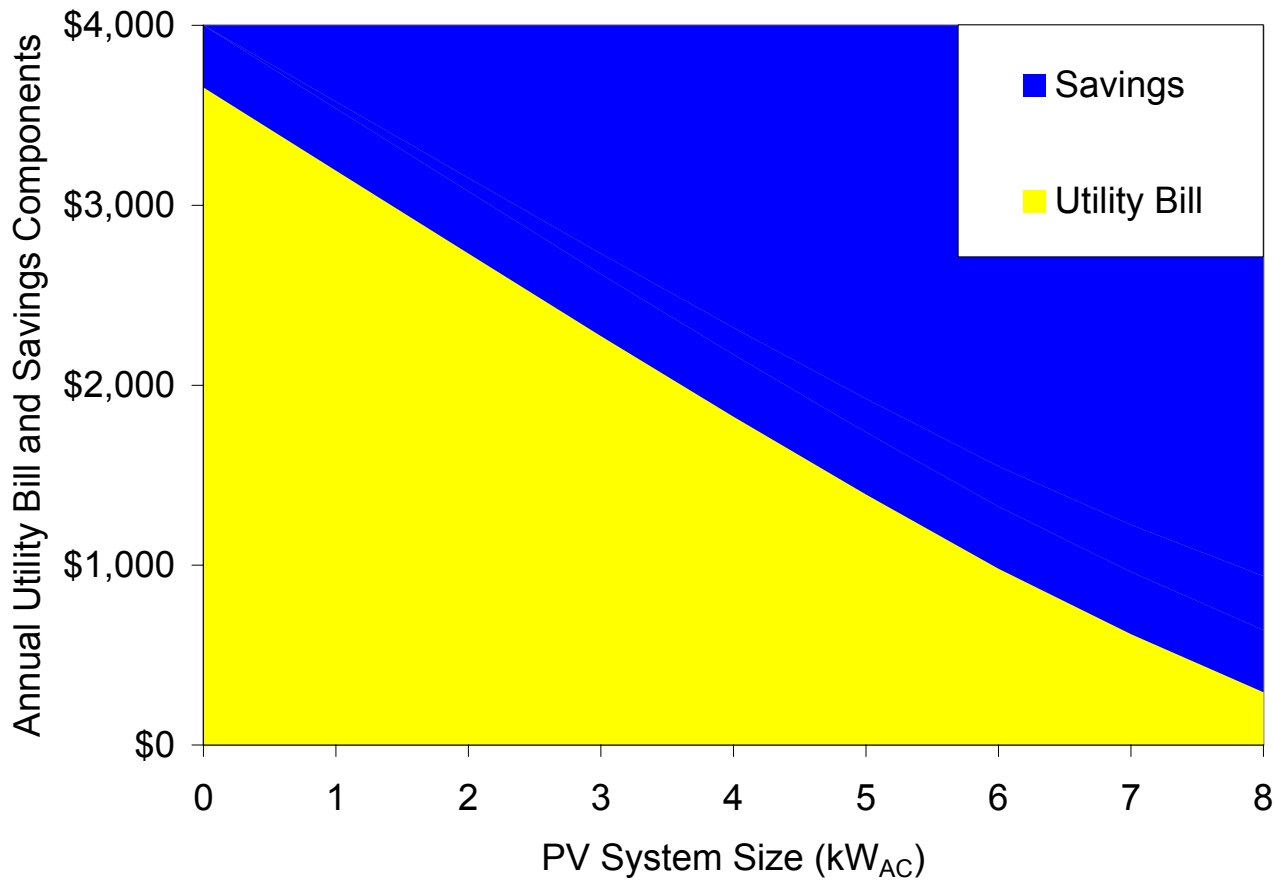
		E-1	E-7 (TOU)				
		All Year	Summer		Winter		
			(May – Oct.)		(Nov. – April)		
	Consumption Charges ↓		Peak	Off-Peak	Peak	Off-Peak	
Time Based Charges→		\$0.13	\$0.31	\$0.08	\$0.11	\$0.08	
	(% Baseline)						
	0% – 100%	\$0.00	\$0.13	\$0.31	\$0.08	\$0.11	\$0.08
	101% - 130%	\$0.02	\$0.14	\$0.33	\$0.10	\$0.13	\$0.10
	131% - 200%	\$0.07	\$0.19	\$0.38	\$0.15	\$0.18	\$0.15
	201% - 300%	\$0.11	\$0.24	\$0.42	\$0.19	\$0.22	\$0.19
	>300%	\$0.13	\$0.26	\$0.44	\$0.21	\$0.24	\$0.21

Rate Structures as of January 1, 2004

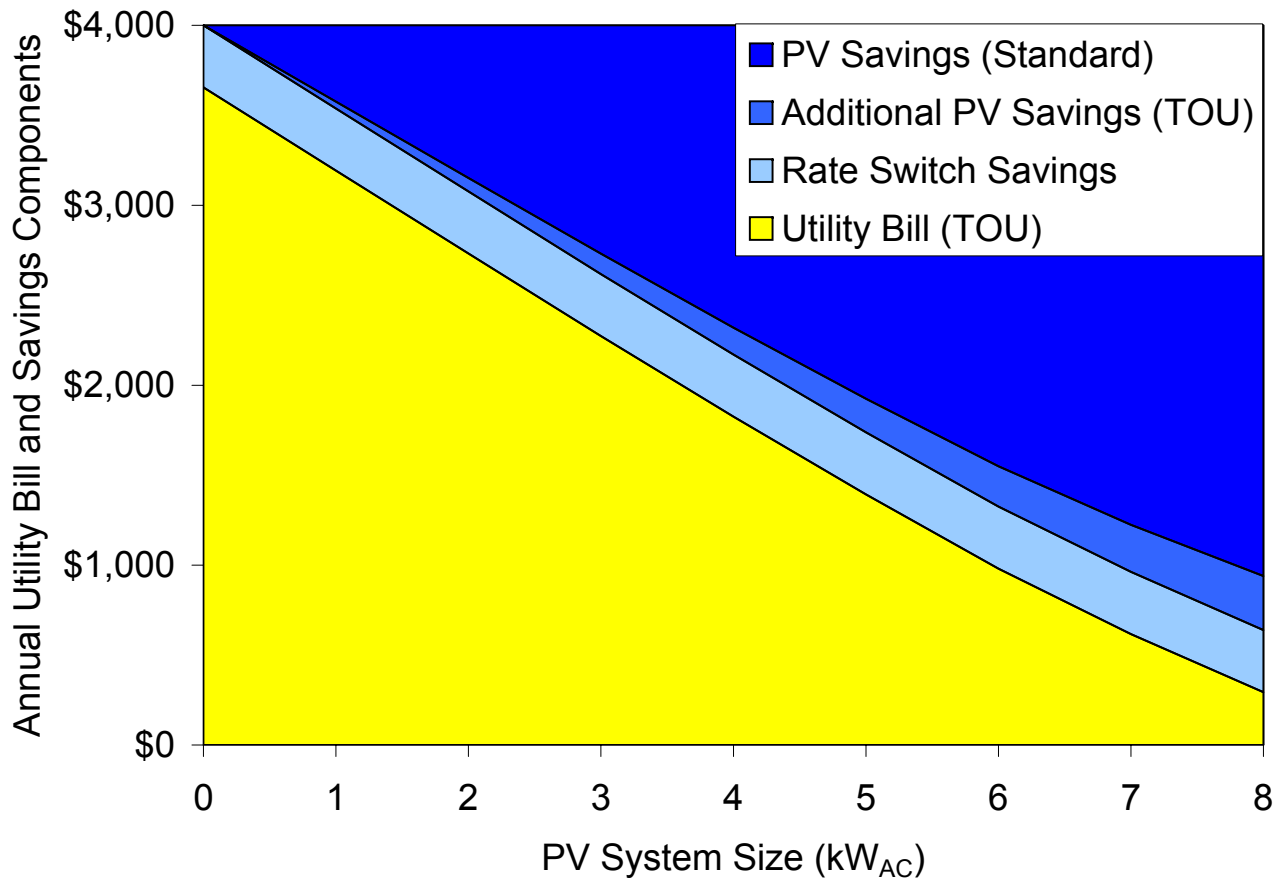
Utility Bill Savings (standard current rate, standard proposed rate)



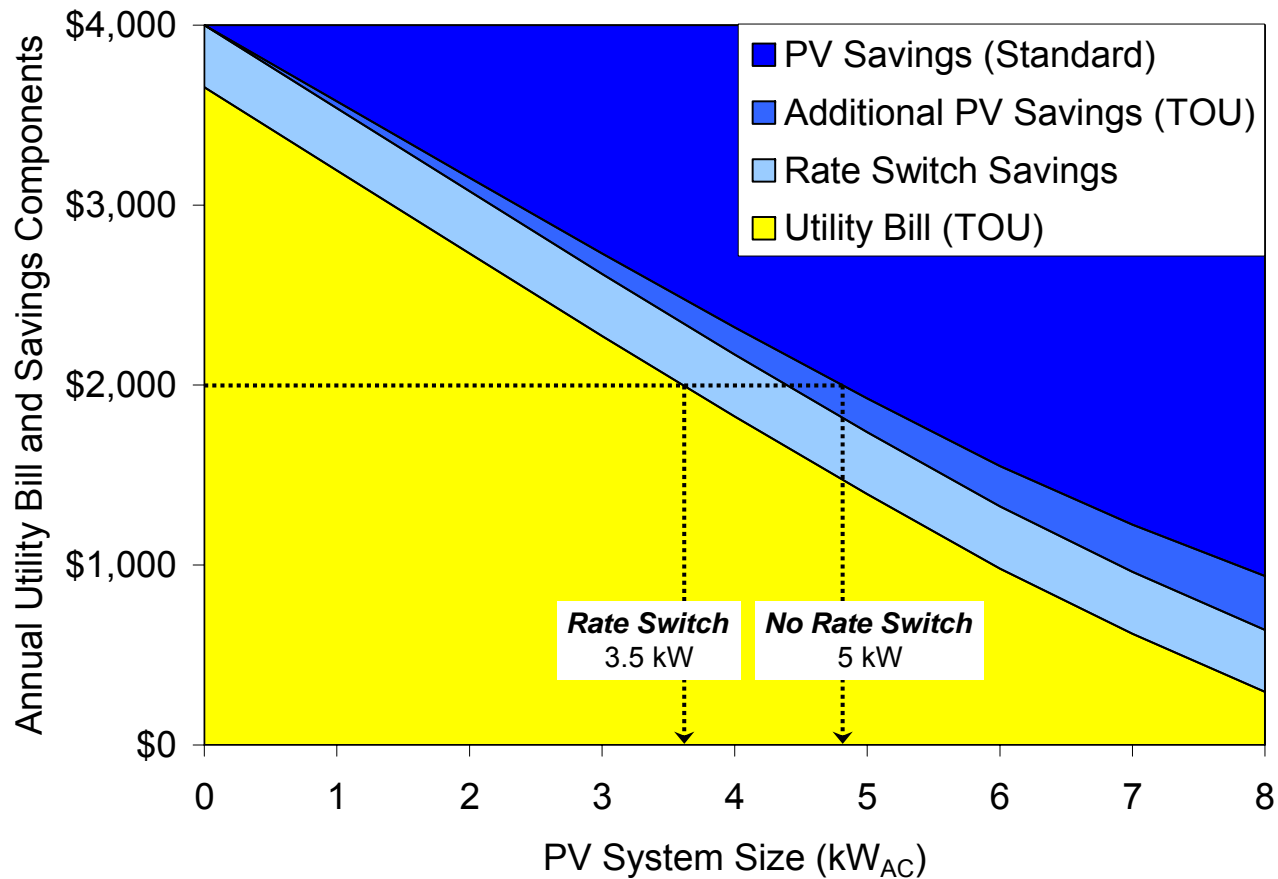
Utility Bill Savings (TOU current rate, TOU proposed rate)



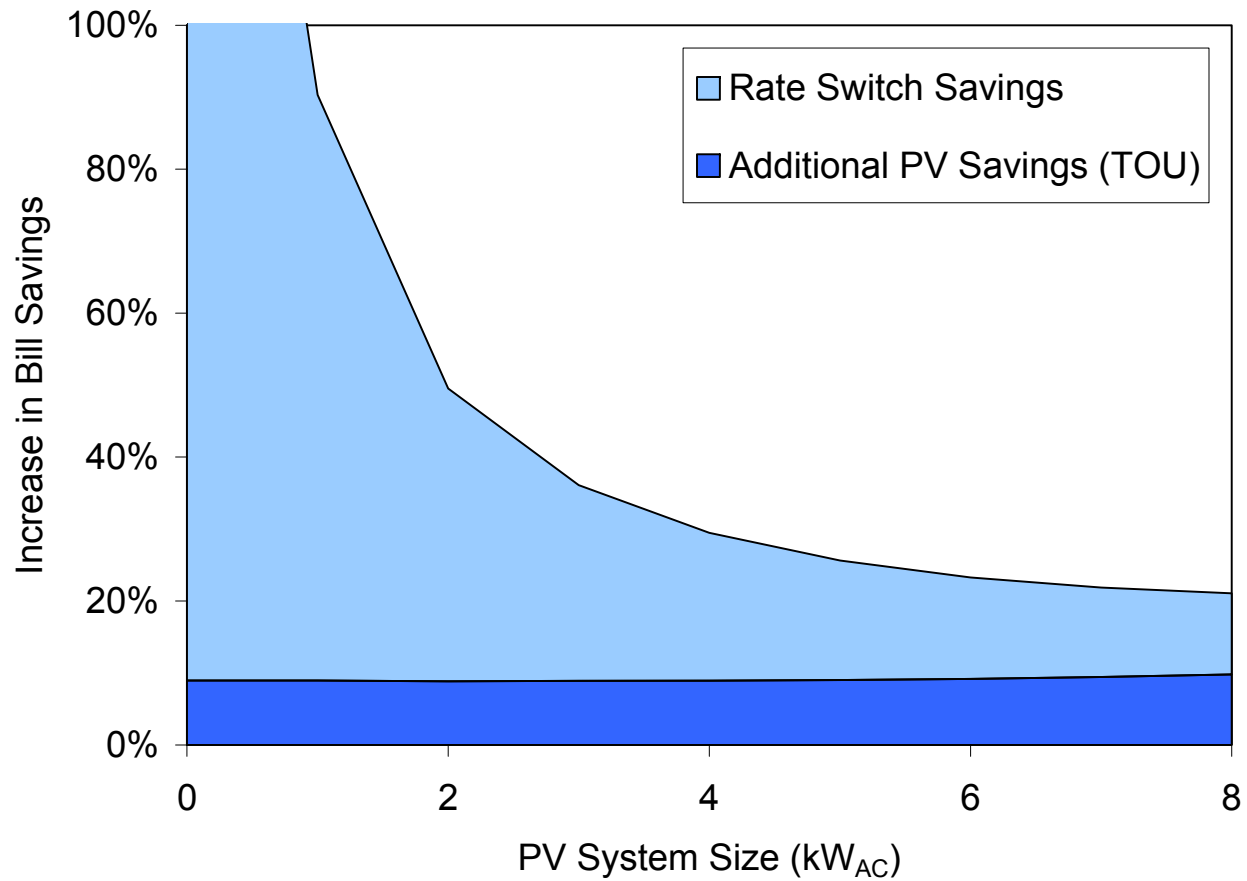
Utility Bill Savings (standard current rate, TOU proposed rate)



PV system can be smaller with rate switch to have same bill savings



Percentage increase in savings depends on PV size and current bill



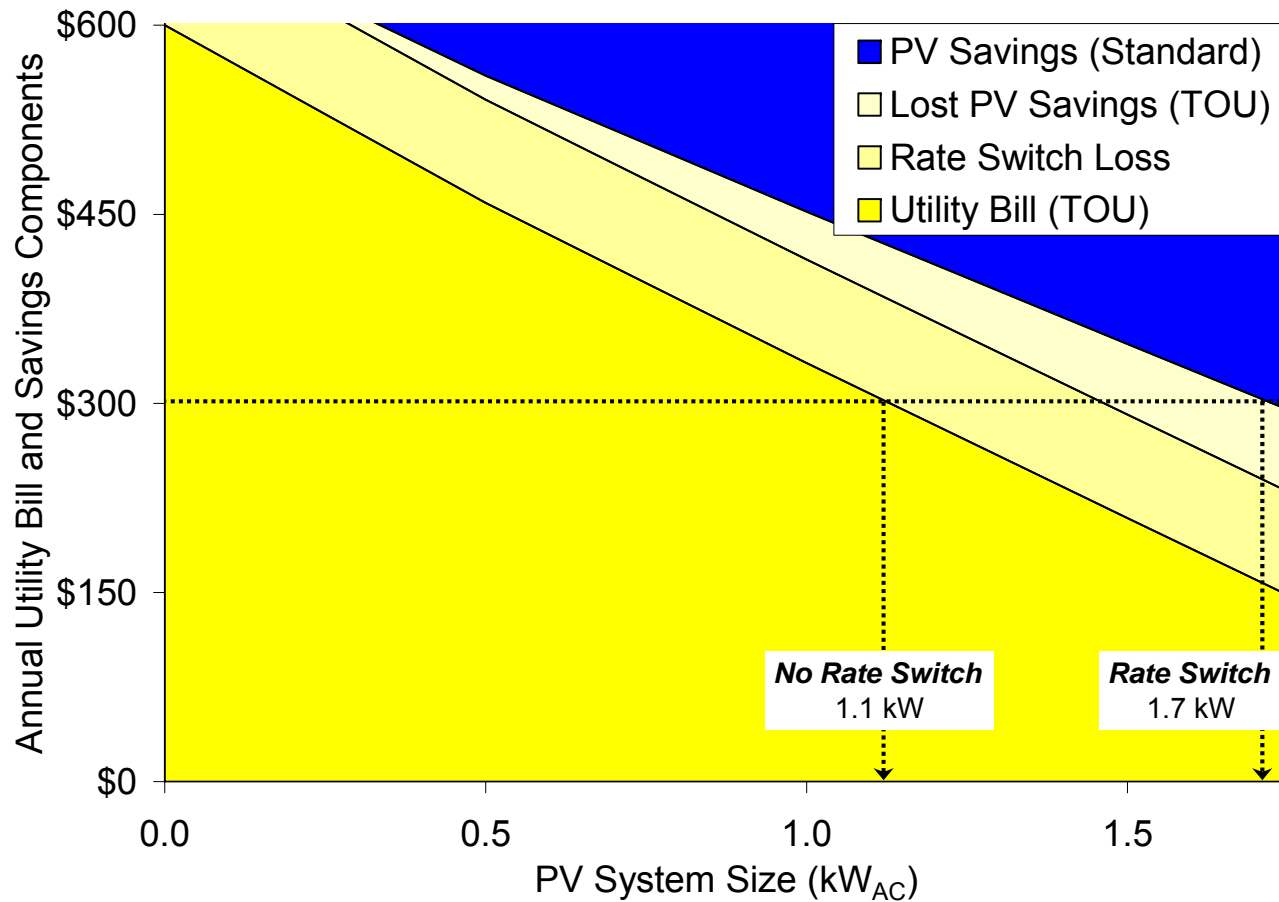
What about a switch from TOU current rate to standard proposed rate?

- Results suggest that PV size can be reduced by incorporating rate switch from a standard to a TOU rate
- PG&E charges \$277 for a net meter TOU meter whether or not the customer currently has a standard TOU meter
- Are small users economically justified in paying the TOU meter charge?

Assumptions

- Residential customer in San Jose, CA (PG&E)
- Typical PG&E E-7 load profile
- Switch from TOU rate (E-7) to standard rate (E-1)
- QuickQuotes (powered by Clean Power Estimator analysis engine) is the analysis tool

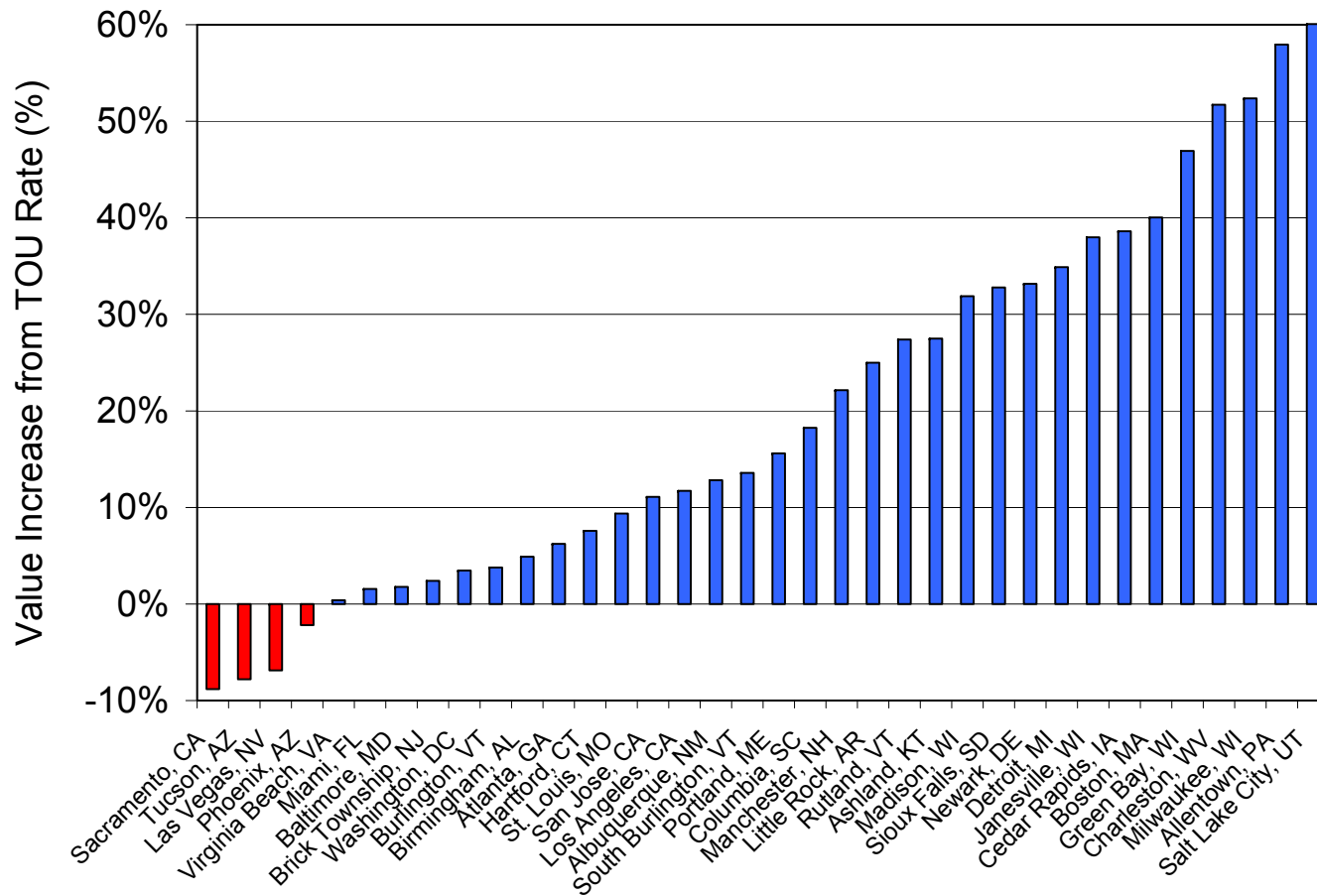
Switching from standard to TOU rate requires larger PV system



Analysis is extended throughout U.S.

- Residential customers are revenue neutral between standard and TOU rates
- Customers consume 10,000 kWh per year
- A 2 kW_{DC} PV system is installed
- Annual net metering
- TOU rates with demand charges are excluded

Change in PV value is location dependent, but is generally positive



Conclusions and Future Work

- PV systems are generally worth more on net metered TOU rates when residential customers are economically indifferent between a standard and TOU rate without PV
- Analyses that are overly simplistic in their evaluation of load effects may produce inaccurate results
- Bundling PV with a rate switch can be very positive economically, but load profiles become important
- Next phase of work is to add more load profiles to analysis and to perform for more locations